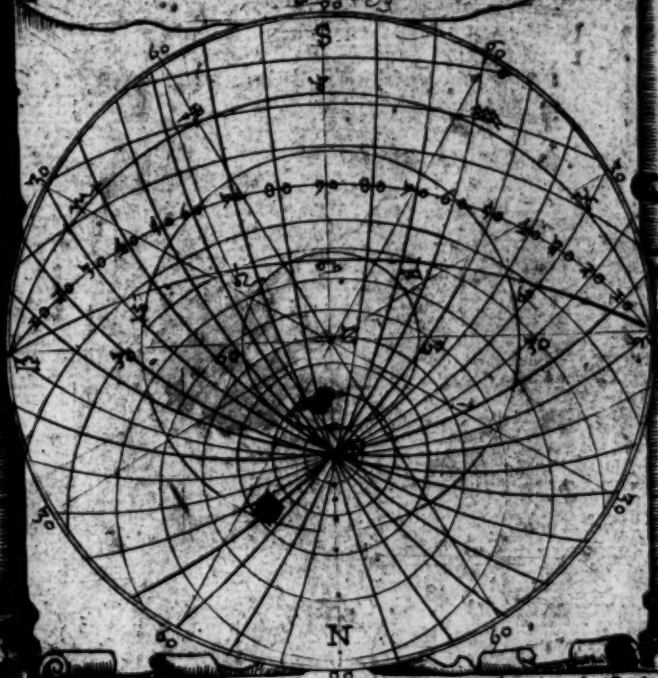
The making, description, and vse of a small portable Instrument for y Pocket (or according to any Magnitude) in forme of a mixt Trapezia thus Called a Horizontall Quadrant.

Composed and proposed now for the benefit and vse of such which are studious of Mathematicall Practice.

Written and delivered by Delamain, Student and Teacher of the Mathematickes.

Attribuit nullo præcepto tempore vitæ
vsteram nobis ingenijq; Deus.



London printed for Richard Hawkins and are to be sold at his shop in Chancery lane neere Sarjants Inne 1632.

TO
The right Honorable and his much honoured Lo.
Thomas Lo. *Brudenel*, Baron of *Stanton*.

Right honourable, and my very good Lo.

YOur *ſingular knowledge in all excellent, and ſolid* Literature, *and your ever Heroicke, and Noble diſpoſition to the beſt kinds of* Learning, *are not unknowne unto the world; And amongſt*

other ſtudies in your Lo. minoritie at the Vniverſitie, you tooke no little affection, to the Mathematicall Arts, as by your Lo. owne Manu-ſcripts and excellent Bookes in your Lo. great Libra-rie I have often ſeene; Beſides, not onely by mine owne ſundry conferences with your Lo. but alſo by the relation of others of more mature judgement I have bin amply informed in theſe your L. more aged yeares not onely of your continued love to theſe Arts, but alſo that your knowledge in them far exceedes many of the Nobilitie of this kingdome. Now my L. when I cauſed the ſubject of this Tractat to be made for your Lo. laſt Summer (I meane your Lo. Horizontall Quadrant) I had not then any intention ſo ſoone to have written publikely upon it; But, having then but declared unto your Lo. the excellent and abundant uſe of the In-ſtrument

ſtrument *by the heads of the* propoſitions *then ſlightly compiled,* (*farre exceeding the* Inſtrumentall *way in this nature, that eyther* Nobilitie, Gentrie, *or others are now acquainted with in this* kingdome, *for a recreative* Inſtrument, *as well for the copious uſe thereof, as its great facilitie, and expedition in operation*) *your Lo. then incouraging me to the publiſhing of it for a generall end; many* Moneths *after* I *conſidered thereon: and drew it up into a* Body, *and thus accommodated it, as* I *here preſent it now unto your Lo. favourable cenſure, and* Patronage (*to be ſheltred under the wings of your Lo. clemency againſt all calumniators and malevolents*) *as belonging eſpecially to your Lo. ſith you were the ſole motive to this worke, and had both the uſe of the* Inſtrument *before it came*

thus to a publicke view, and the first Quadrant that ever was made common in this kind: accept therefore favourably I beseech your Lo. this small mite of my labours, as from the hands of one of your poorest servants (yet true affectionate) who shall alwayes acknowledge your Lo: Noblenesse towards him, and ever rest

Your Lo.

most humbly devoted

to Honour and

serve you

De la main.

To the Reader.

Before I ſhew the *Projection*, deſcribe the particulars, and deliver the uſes of this *Horizontall Quadrant*, it will not bee impertinent, for the ſatisfaction of ſome, to give the *Reader* to underſtand what moved me unto it, how it exceeds other *Inſtruments*, and whence it might be drawne, and projected.

Now the ingenious aptneſſe for *Invention*, and accomodating of things in a faire and expedite courſe for *Mathmaticall Practices*, of that late profeſſor of *Aſtronomy* M^r. *Gunter* is not unknowne unto many about this kingdome, ſatisfying many of his friends (according to his free and noble affection) by *Tranſcripts* in that of more ſolid matter, but ſuch of vulgar *Practices* he hath publikely made manifeſt for the uſe of all ſuch as affect thoſe *Studies*. *In* which worke many yeares paſt I tooke occaſion to conſider the *Scheme*, or *Diagramme* of the fourth *Projection* in his

his *Booke* of the *Sector* Page the 64. & 65. wch according as he saies is after the manner of the old *Concaue hemisphere* (but being in truth a naturall *Projection* of the visible *Hemisphere*, that is, one Moytie of the *Globe*, projected on a *Plaine*) which *Diagram* and *Projection* is now chalenged by my Reverend good friend *Master Oughtred*, and it should seeme that *Master Gunter* had the Original of it from his labours, & invention, who composed and made the same so, for more then thirty yeares past, as appeares by his owne *Writings*, & *Manuscripts* upon that *Projection* shewen me in the time of the Printing of this *Tractat* upon my *Horizontall Quadrant*, whose excellent knowledge in *Mathematicall* Learning may evidently confirme it: which *Projection* the said *Master Oughtred* gave to the late *Bishop* of *Winchester*, *Doctor Tilson*, for more then 20. yeares past, and to some others of very good quality.

And it may also, by a Letter from that most famous and admired *Geometer*, *Master Henry Brigges* unto *Master Oughtred* dated from *Gresham Colledge Iune*, the 2. *Anno*, 1618. be collected that the said *Master Gunter* had the first overture of that fourth *Projection*, from the said *Master Oughtred*, in which *letter* are these words: *Master Gunter* doth here send you the *Print* of an *Horizontall Diall* of his drawing after your *Instrument*; And afterwards the said *Projection* was also presented by *Master Gunter* to many Noble *Personages*, and in particular to

the *Right Honourable* the *Earle* of *Bridgewater*, causing it to be cut in *Brasse*, in such a forme as I have placed at the end of this *Tractat*, some uses of which *Dial* are extant, viz. the 2. 18. 21. and 34. *Pro.* of the *Index* or *Table* following.

Now having considered diverse *Pocket Instruments* (that many men are practised in) & looked into sundry *Projections*, amongst which that of *Gemmafrisius* (there drawne in the *Booke* of the *Sector*) is of admirable use, yet making a more serious quære, & contemplating more intensively upon that *Diagram*, drawne and specified in that 64. and 65. Pages of the *Sector* (aforesaid) I found it farre to exceede all others in the *Multiplicity*, and excellencie of performance.

If I should adde unto it a *Kalender* of *time*, and an *Index* graduated with an *Axis*, and *Perpendiculars* to be erected vpon it at pleasure: & referring only the *Trapezium forme*, it should be fitted farre to exceede any portable *Instrument* for the *Pocket*, ever yet produced in respect of the generall uses of it: in resolving such ordinary *Propositions* which are practiced in *Astronomie*, upon the *Globe*, *Sphæare*, *Hemisphæare*, *Quadrants* of all sorts, *Astrolabe* of *Frisius*, *Blagraue*, and others for facility, expedition, or certaintie, (like *Magnitudes* considered) for in these *Instruments* for severall times, and severall *Propositions*, there must be diverse rectifications of the parts belonging to these *Instruments*, and

that diverſly by reaſon of their diverſity: By this *Horizontall Quadrant*, the former rectifications are avoided, Contemplation & the eye being only the *Index*, the aptneſſe, & fitneſſe of the parts, and lines ſo naturally projected, or deſcribed as they are upon the plaine of the *Inſtrument* (being a part of the *Horizon* the *Parallels Meridians*, & *Verticall Circles*, that are contained or may be deſcribed in our *Latitude* ſufficiently neceſſary) induceth any one in the underſtanding of the uſes of it that is but indifferently verſed in the linaments and principles of the *Globe*, what to ſpeake, and what to anſwere in a *Propoſition* without farther direction: And having had this *Horizontall Quadrant* for many yeares paſt, as a *Pocket Inſtrument*, diverſe about this *Kingdome* being importunate with me for to have it, or to publiſh the uſe of it, ſeeing its great facilitie, and expedition, in compariſon of ſuch *Pocket Inſtruments* as are now uſed, here, or in forraigne parts: I was willing at laſt after I had given order for the making of fower of theſe *Inſtruments* in *Silver* for ſeverall *Noble Perſonages*, to disburthen my ſelfe of *Tranſcribing* the uſes of the *Inſtrument*, and *Tables* for the making of it, to ſatiſfie thoſe which were importunate, and to let others that are ſtudious in *Mathematicall Practices* alſo participate of it.

Now, what I have delivered vpon the accommodating of the *Inſtrument* thus, the making thereof, with the uſes that I have

have delivered in this *Tractat* upon it following: I acknowledge due to none *Inferiour assistant*, but to mine owne *Industry*, *search* and *labour*, and that 64. 65. and 66. *Pages* of the *Booke*: of the *Sector* before specified in which is onely shewne the 2.3.19.22.25. and 30. *Propositions* of the *Index*, or *Table* following, as uses of the said *Projection*.

But I have extended them to many more, and abundantly, and plentifully supplied the obscuritie of that *Scheme*, or *Diagramme* there drawne (as for a generall good) in the use of this *Horizantal Quadrant*. I deliver therfore first the making of it, first by the *Sector* (somewhat different from that of *Master Gunners*) secondly by *Geometrie*, and lastly I shew a third way, how it may be *Projected* and made by my *Mathematicall Ring*, and by *Numbers*, which I have *Calculated* and accommodated to that end in *Tables*, for more exactnesse. *Part* of the generall scope, and use of which *Instrument* I deliuer in the *Index*, or *Table* following.

An Index, or Table of the Vses of the Horizontall Quadrant.

Viz of the
- Horizon.
- Line of Shadowes.
- Kalender.
- Parallels.
- Æquator.
- Ecliptick.
- Houre-lines.
- Index.

I. By the Horizon to shew.
1. The *Sunne*, or *Starres Altitude* at any time. Pag. 53.
2. At any *Day* of the *yeare*, how farre the *Sun riseth*, or *setteth* from the true *East* or *West*. Pag. 28.
3. The *Suns Azimuth*, and *Altitude*, at any *houre*, for any *day*, Pag. 62.
4. The *Meridian* line, upon any appearance of the *Sunne*. Pag. 55.
5. The vncertaintie of *time*, by noting the *Shadow* of things, Pag. 63.
6. The *Site* of a *Building*, or Costing of a *Place*. Pag. 57.
7. The *Variation* of the *Needle*. Pag. 59.
8. The *Declination* of a *Wall*, or *Plaine*, the *Sunne* shining thereon, Pag. 71.
9. The *Inclination* of a *Plaine*, and to place a *Plaine Horizontall*, Pag. 89.
10. At

19. At what *houre* in any *Day* of the *yeare* the *ſhadow* of an *Altitude* is equall, double, triple, &c. unto it. Pag. 35.
11. Inſtantly the *houre* of the *day*, the *Azimuth* and *Altitude* of the Sun, with the *Meridian line*, without obſervation or ſight of the *Sun*, by knowing the *Proportion* betweene the length of a *ſhadow* upon a *Horizontall Plaine* & that which caſts the *ſhadow*. Pag. 67.

2. *By the line of ſhadowes ſhada*
12. At any *houre*, an *Altitude* of the *Sun*, or *Azimuth*, what Proportion *ſhadowes* have to their *Bodies*. Pag. 37.
13. Whether and *Altitude* be above, or below the ſewell of the eye, & how much.
14. The hight of an *Altitude*, acceſſible, or in acceſſible. Pag. 100. 101.
15. The meaſure of any Part of *Altitude* not approchable. Pag. 102.

16. The inequality of *Time*, in equall *Months*, or equall number of *Dayes* Pag. 44.
17. What number of *dayes* wil make the *day* and *houre* longer, or ſhorter at any time. Pag. 43.
3. *By the Kalender is knowne.*
18. The *houre* of the *Sun riſing*, *ſetting*, with the length of the *day at any time*, Pag. 23.
19. What *dayes* are alike in length, & what *day* the *Sun riſing* in the one, ſhall be the *Sun ſetting* in the other, Pag. 24.
20. The inequality of *Time* between day breake, and *Sun riſing*. Pag. 41.

21. At any day the *Suns declination*. Pag. 24
22. The *Latitude* of a *Place*, or hight of the *Pole* above the *Horizon*, Pag. 60.
4. *By the Parallels to ſearch out.*
23. At what *houre* in any *day*, the *Suns Azimuth*, and *Altitude* will be equall, and how much the *Altitude* & *Azimuth* wil be. Pag. 42

24. The

5. By the Æquator is ſeene
24. The *Suns* equall motion, *right Aſcention*, and *oblique Aſcention*, Pag. 26.
25. The *Sunnes Place* at any time of the yeare, Pag. 25.
26. The Degree of the *Æquator* in the *Horizon*, by ſuppoſing the degree of the *Ecliptick* in the *Horizon*, Pag 46.
27. The Degree of the *Eclipticke* in the *Horizon*, by ſuppoſing the degree of the *Æquator* in the *Horizon*. Pag. 47.
6. By the Eclipticke to give
28. The degree of *Medium Cœli*, or the degree of the *Eclipticke* in the *Meridian*, by ſuppoſing the degree of the *Eclipticke* in the *Horizon*, *Vel* contra. Pag. 47.
29. The *Horoſcope*, or the degree *aſcendant*, or *deſcendant*, and the *Nonageſima* degree at any *houre*. Pag. 49.
30. What Angle the *Eclipticke* makes with the *Horizon*, or the *Altitude* of the *Nonageſima* degree and what *Azimuth* it is in at any *houre*, Pag. 50.
7. By the hour lines to find
31. The *houre* of the *Day*, and *Azimuth* of the *Sunne*, Pag. 54.
32. The *houre* of the *day* agreeable to any *Altitude*, or *Azimuth*, Pag. 39.
33. The *Sunnes* Difference of *Aſcention* for any *day*, Pag. 23.
34. The *Quarter* of the *yeare*, and *day* of the *moneth*, *houre* of the *day*, *Meridian-line*, and *Azimuth* of the *Sunne*, if it were forgotten: Pag. 64.

35. At

35. At what *houre*, & *Altitude*, the *Sun* will be due *East*, at any *day* of the *yeare*, Pag. 27.
36. The *Suns Azimuth*, & *houre* without obſervation, Pag. 58.
37. The time of *day-breake*, or end of *Twi-light*, for any *day* in the *yeare*, Pag. 30.
38. The *hight* or *Depreſſion* of the *Sun* in the *Meridian*, for any *day* in the *yeare*, here or for any *Latitude*, Pag. 29.
39. The *Suns depreſſion* & *Azimuth*, at any *houre* of the *Night* aſſigned, Pag. 40.
40. The *houre* of the *day* to our *Antipodes*, by ſuppoſing the *ſuns depreſſion* under the *Horizon*, Pag. 42.
41. What *houre*, & *Altitude* the *ſunne* commeth upon a *declining wall*, any *day* in the *yeare*, & how long the *ſun* ſhineth thereon, Pag. 32.
42. At what *houre* and *Altitude* the *Sun* muſt have, to be oppoſite or Perpendicular to a *Declination Plaine*, Pag. 33.
43 The *declinatiõ* of *a wall*, by ſeing the *ſun* beginning to ſhine thereon, or going from it, Pag. 69.
44. The *houre* & *Altitude* of a *ſtars* coming to the *Meridian* at any *Night* in the *yeare* aſſigned, Pag. 74.
45. The time of the *riſing*, *ſetting*, & continuance of a ſtarre above the *Horizon*, & in what part of the *Hemiſphere* they may be ſeene, with the *Azimuth* and *Altitude* thereof at any *houre*, Pag. 78.
46 In what part of the *Horizon* a *ſtarre riſeth* or *ſetteth*, and at what *houre* & *Altitude* it will be due *Eaſt* or *Weſt*, Pag. 80.
47. What *Azimuth* any *ſtarre* is in, upon any appearance thereof, with the *houre* of the *night*, Pag. 82.
48. How to meaſure the Quantitie of an *Angle*, or to finde the diſtance of two *Starres*, Pag. 85.
49. How to meaſure *Diſtances*, and *Bredths*, Pag. 87.
50. How to take the *Circuit* of a *Figure*, or the *ſurveigh* of a *Place*. Pag. 93.

8. *By the Index adioyned with other lines you have.*

Much

MVch more I might have laid open upon the vſe of this *Inſtrument*, as the making of *Horizontall*, *direct*, *declining*, *cilindrical*, & *Ring dyalls*, the diſtance of the *houres*, *ſubſtiler* & *ſtiles* hight, *Stoſlerius Aſtrolabe*, *Maſter Gunters Quadrant*, with many other *Inſtruments*, now vſed, but let theſe be ſufficient for the preſent; the ingenious, may eaſily adde vnto that which I have delivered, & therefore I ſhew firſt how to project the *Inſtruments*, then the *Deſcription*, and laſtly how theſe vſes, are compendiouſly contracted, and operated.

The Tables for making of the Horizontall Quadrant.

The Table for the describing of the Parallels.

G	A	B	C	F	E	D
58 20	♈	37 30	76732	162173	401078	70 00
57 49	-3	37 15	76041	158854	393750	75 45
56 45	22	36 45	74673	152576	379826	75 15
55 44	21	36 15	73323	146736	366795	74 45
54 42	20	35 45	71989	141292	354573	74 15
53 43	19	35 15	76673	136205	343084	73 45
52 41	18	34 45	69372	131445	332263	73 15
51 46	17	34 15	68087	126982	322052	72 45
50 50	16	33 45	66817	122791	312399	72 15
49 55	15	33 15	65562	118848	303259	71 45
49 01	14	32 45	64322	115134	294590	71 15
48 09	13	32 15	63095	111630	286356	70 45
47 17	12	31 45	61881	108321	278523	70 15
46 28	11	31 15	60681	105190	271061	69 45
45 38	10	30 45	59493	102226	263945	69 15
44 50	9	30 15	58318	99415	257149	68 45
44 03	8	29 45	57154	96748	250651	68 15
43 18	7	29 15	56002	94215	244432	67 45
42 34	6	28 45	54861	91805	238472	67 15
41 50	5	28 15	53731	89512	232756	66 45
41 08	4	27 45	52612	87327	227267	66 15
40 27	3	27 15	51503	85244	221991	65 45
39 47	2	26 45	50404	83256	216916	65 15
39 08	1	26 15	49314	81358	212030	64 45
38 29	0	25 45	48234	79498	207231	64 15
37 53	1	25 15	47163	77808	202719	63 45
37 17	2	24 45	46100	76148	198396	63 15
36 43	3	24 15	45046	74558	194162	62 45
36 08	4	23 45	44001	73033	190068	62 15
35 36	5	23 15	42963	71572	186109	61 45
35 03	6	22 45	41933	70171	182275	61 15
34 33	7	22 15	40911	68825	178562	60 45
34 02	8	21 45	39895	67538	174963	60 15
33 32	9	21 15	38887	66292	171472	59 45
33 03	10	20 45	37886	65099	168084	59 15
32 36	11	20 15	36891	63951	164994	58 45
32 08	12	19 45	35903	62847	161598	58 15
31 42	13	19 15	34921	61784	158490	57 54
31 17	14	18 45	33945	60761	155467	57 15
30 52	15	18 15	32975	59775	152525	56 45
30 28	16	17 45	32010	58825	149660	56 15
30 05	17	17 15	31050	57909	146869	55 45
29 42	18	16 45	30096	57026	144149	55 15
29 19	19	16 15	29147	56174	141496	54 45
28 57	20	15 45	28202	55353	138908	54 15
28 36	21	15 15	27263	54559	136382	53 45
28 16	22	14 45	26327	53794	133916	53 15
27 57	23	14 15	25396	53055	131506	52 45
27 47	69	14 00	24932	52695	130522	52 30

K

The Table for puting on the Kalander in the Horizon.

	I	F	M	A	M	I	I	A	S	O	N	D
1	36 37	22 40	5 41	13 41	29 46	39 12	37 20	25 06	7 19	11 27	29 00	39 04
2	36 19	22 07	5 02	14 17	30 13	39 19	37 05	24 37	6 42	12 05	29 28	39 13
3	35 58	21 33	4 24	14 53	30 39	39 21	36 49	24 05	6 05	12 42	29 58	39 23
4	35 38	20 58	3 46	15 29	31 04	39 33	36 32	23 34	5 28	13 24	30 24	39 29
5	35 20	20 24	3 08	16 04	31 31	39 38	36 15	23 02	4 51	13 59	30 53	39 35
6	34 58	19 49	2 31	16 36	31 54	39 42	35 57	22 30	4 14	14 34	31 19	39 40
7	34 36	19 14	1 53	17 12	32 18	39 46	35 39	21 56	3 35	15 07	31 47	39 44
8	34 14	18 39	1 14	17 48	32 43	39 48	35 20	21 26	2 58	15 44	32 11	39 48
9	33 50	18 02	0 37	18 23	33 05	39 50	35 00	20 52	2 20	16 20	32 36	39 50
10	33 27	17 28	0 02	18 57	33 29	39 52	34 39	20 23	1 43	16 56	33 02	39 52
11	33 03	16 51	0 40	19 31	33 50	39 52	34 20	19 45	1 06	17 31	33 27	39 53
12	32 38	16 15	1 18	20 04	34 12	39 51	34 00	19 12	0 28	18 07	33 57	39 52
13	32 13	15 39	1 56	20 37	34 33	39 51	33 36	18 39	0 10	18 43	34 12	39 50
14	31 47	15 03	2 34	21 11	34 54	39 50	33 08	18 04	0 48	19 17	34 36	39 48
15	31 19	14 25	3 11	21 45	35 14	39 46	32 51	17 31	1 25	19 52	34 58	39 44
16	30 53	13 49	3 50	22 17	35 34	39 42	32 26	16 57	2 04	20 28	35 18	39 40
17	30 26	13 12	4 27	22 49	35 53	39 39	32 02	16 32	2 41	21 01	35 39	39 35
18	29 58	12 36	5 06	23 21	36 12	39 35	31 37	15 46	3 19	21 35	35 59	39 30
19	29 28	11 58	5 44	23 53	36 28	39 29	31 13	15 07	3 56	22 08	36 17	39 25
20	29 00	11 20	6 20	24 24	36 45	39 21	30 48	14 28	4 35	22 44	36 36	39 17
21	28 29	10 43	6 59	24 54	37 00	39 13	30 21	14 01	5 12	23 16	36 53	39 08
22	28 00	10 06	7 35	25 25	37 17	39 06	29 54	13 25	5 50	23 50	37 11	38 58
23	27 29	9 29	8 12	25 56	37 31	38 58	29 28	12 48	6 28	24 22	37 26	38 49
24	27 00	8 50	8 50	26 25	37 45	38 47	29 00	12 13	7 06	24 55	37 41	38 37
25	26 29	8 12	9 27	26 56	37 57	38 37	28 32	11 37	7 44	25 27	37 56	38 26
26	25 56	7 35	10 03	27 26	38 11	38 26	28 04	11 01	8 20	25 58	38 09	38 13
27	25 25	6 57	10 40	27 58	38 22	38 15	27 36	10 24	8 58	26 29	38 23	38 00
28	24 53	6 20	11 16	28 24	38 34	38 02	27 07	9 26	9 35	27 00	38 33	37 47
29	24 21		11 53	28 50	38 45	37 49	26 38	9 10	10 14	27 29	38 45	37 32
30	23 46		12 29	29 17	38 55	37 36	26 08	8 33	10 49	28 00	38 56	37 15
31	23 13		13 07		39 04		25 27	7 57		38 30		36 56

S

The Table for the inserting and dividing the Line of Shadowes.

	0	1	2	3	4	5	6	7	8	9
1	45 00	42 00	39 49	37 34	35 32	33 41	32 00	30 28	29 03	27 46
2	26 33	25 28	24 27	23 30	22 37	21 48	21 20	20 19	19 39	19 02
3	18 26	17 53	17 21	16 51	16 23	15 57	15 31	15 07	14 45	14 23
4	14 02	13 43	13 23	13 06	12 48	12 32	12 16	12 00	11 46	11 32
5	11 19	11 06	10 53	10 41	10 30	10 18	10 07	9 57	9 47	9 37
6	9 27	9 19	9 10	9 01	8 53	8 45	8 37	8 29	8 22	8 15
7	8 07	8 01	7 54	7 48	7 42	7 35	7 30	7 24	7 18	7 13
8	7 07	7 02	6 58	6 52	6 47	6 42	6 38	6 33	6 29	6 24
9	6 20	6 16	6 12	6 08	6 04	6 01	5 57	5 53	5 49	5 46
10	5 43									
15	3 49									
20	2 51									
40	1 26									

The Table for drawing the houre lines

The Table for drawing, and dividing the Ecliptick

The Table for dividing

[illegible]	[illegible]	[illegible]	[illegible]	57909	146869	55 45
29 42	18	16 45	30096	57026	144149	55 15
29 19	19	16 15	29147	56174	141496	54 45
28 5	20	15 45	28202	55353	138908	54 15
28 36	21	15 15	27263	54559	136382	53 45
28 16	22	14 45	26327	53794	133916	53 15
27 57	23	14 15	25396	53055	131506	52 45
27 47	69	14 00	24932	52695	130522	52 30

7	8 07	8 01	7 54	7 48	7 42	7 35	7 30	7 24	7 18	7 13
8	7 07	7 02	6 58	6 52	6 47	6 42	6 38	6 33	6 29	6 24
9	6 20	6 16	6 12	6 08	6 04	6 01	5 57	5 53	5 49	5 46
10	5 43									
15	3 49									
20	2 51									
40	1 26									

The Table for drawing the houre lines

	T. 125717		P.34921		
		H		I	
	1	1745	46	103553	
	2	3492	47	107236	
	3	5240	48	111061	
	4	6992	49	115063	
	5	8748	50	119175	
	6	10510	51	123489	
	7	12278	52	127994	
	8	14054	53	132704	
	9	15838	54	137638	
	10	17632	55	142814	
	11	19438	56	148256	
	12	21255	57	153986	
	13	23086	58	160033	
	14	24932	59	166427	
7	15	26794	60	173205	10
	16	28674	61	180404	
	17	30573	62	188072	
	18	32491	63	196261	
	19	34432	64	205030	
	20	36397	65	214459	
	21	38386	66	224603	
	22	40402	67	235585	
	23	42447	68	247508	
	24	44522	69	260508	
	25	46630	70	274747	
	26	48775	71	290421	
	27	50952	72	307768	
	28	53170	73	327085	
	29	55430	74	348741	
8	30	57735	75	373205	11
	31	60086	76	401078	
	32	62486	77	433147	
	33	64940	78	470463	
	34	67450	79	514455	
	35	70020	80	567128	
	35	72654	81	631375	
	37	75355	82	711536	
	38	78128	83	814434	
	39	80978	84	951436	
	40	83909	85	1143005	
	41	86928	86	1430067	
	42	90040	87	1908114	
	43	93251	88	2863625	
	44	96568	89	5729869	
9	45	100000	90		12

The Table for drawing, and dividing the Eclipticke

♑. 26794.			♋. 188072.		
K	L	M	N	O	P
1	0 55	2604	46	43 31	94951
2	1 50	3200	47	44 31	98326
3	2 45	4893	48	45 28	101642
4	3 40	6408	49	46 32	105500
5	4 35	8016	50	47 32	109258
6	5 31	9658	51	48 34	113294
7	6 25	11246	52	49 34	117361
8	7 21	12899	53	50 35	121669
9	8 10	14350	54	51 37	126244
10	9 12	16196	55	52 38	130952
11	10 07	17842	56	53 43	135967
12	11 03	19528	57	54 42	141235
13	11 57	21164	58	55 44	146777
14	12 53	22872	59	56 46	152822
15	13 48	24562	60	57 48	158797
16	14 42	26234	61	58 51	165445
17	15 40	28045	62	59 54	172509
18	16 36	29811	63	60 57	180034
19	17 31	31561	64	62 00	188072
20	18 28	33394	65	63 03	196685
21	19 24	35215	66	64 06	205941
22	20 20	37057	67	65 10	216089
23	21 16	38921	68	66 13	226909
24	22 12	40809	69	67 17	238862
25	23 09	42756	70	68 21	251928
26	24 06	44836	71	69 25	266280
27	25 03	46737	72	70 29	282130
28	26 00	48773	73	71 34	300028
29	26 57	50842	74	72 38	319752
30	27 54	52947	75	73 43	342342
31	28 51	55089	76	74 47	367638
32	29 49	57309	77	75 53	357637
33	30 46	59533	78	76 57	431429
34	31 44	61841	79	78 02	471812
35	32 42	64198	80	79 07	520107
36	33 40	66607	81	80 12	578938
37	34 39	79114	82	81 17	652233
38	35 37	61636	83	82 23	747805
39	36 36	74266	84	83 28	873171
40	37 35	76964	85	84 33	1048126
41	38 34	79733	86	85 38	1309576
42	39 33	82580	87	86 48	1761056
43	40 32	85508	88	87 49	2622964
44	41 32	88576	89	88 55	5288211
45	42 31	91686	90	90 00	

The Table for dividing the Index.

	Q.		Q
1	872	46	42447
2	1745	47	43481
3	2618	48	44522
4	3492	49	45572
5	4366	50	46630
6	5240	51	47697
7	6116	52	48773
8	6992	53	49858
9	7870	54	50952
10	8748	55	52056
11	9628	56	53170
12	10510	57	54295
13	11393	58	55430
14	12278	59	56577
15	13165	60	57735
16	14054	61	58904
17	14945	62	60086
18	15838	63	61280
19	16734	64	62486
20	17632	65	63707
21	18533	66	64940
22	19438	67	66188
23	20345	68	67450
24	21255	69	68728
25	22169	70	70020
26	23086	71	71329
27	24007	72	72654
28	24932	73	73996
29	25861	74	75355
30	26794	75	76732
31	27731	76	78128
32	28674	77	79543
33	29621	78	80978
34	30573	79	82433
35	31529	80	83909
36	32491	81	85408
37	33459	82	86928
38	34432	83	88472
39	35411	84	90040
40	36397	85	91633
41	37388	86	93151
42	38386	87	94896
43	39391	88	96568
44	40402	89	98269
45	41421	90	100000

Of the Making of the Horizontall Quadrant by the Sector.

First, according to any *Semidiameter* as *ZN.* or *Z S.* describe a Circle representing the *Horizon*, and draw the line *S N.* for the *Meridian*: Divide the halfe *Meridian ZN.* and *Z S.* into 90.gr. according to the *Tangents* of halfe their Arkes, by the helpe of the *Sines* on the edge of the *Sector*: or the semidiameters may be divided into such parts, or points as are required concerning the *Projection*, thus. Consider what parallels you would describe, and how much they are distant from the *Zenith* in their intersections, in the *Meridian* both towards the South and North of the *Zenith* (for every parallell in an oblique *Spheare*, in his intersection with the *Meridian*, is farther from the *Zenith* in one part, than in an other) Then if the semidiameter *Z N.* be placed over in the *signe Complement* of halfe that distance, from the Zenith, the parallell *Sine* of the former halfe taken from the *Sector*: shall from Z shew the intersection in the *Meridian* with that parallell.

1. How to describe the Parallels.

So if the parallels were the		whose distances of intersections in the Meridian (according to the Lat. of 51. gr. 30. m.) from Z. towards			gr. m.	The halfe of these Arks are	gr. m.
	Tropicke of ♋		S. the South		28. 0.		14.00. A
			N. the North		105.0.		52.30. B
	Æquator		S. the South	is	51.30.		25.45. C
			N. the North		128.30		64. 15. D
	Tropicke of ♑		S. the South		75.30.		37.30. E
			N the North		152.0.		76.00. F

Now if the ſemidiameter *Z.S.* bee placed in the *Sine Complement* of A.viz. 76.gr. and then the parallell Sine of A taken,viz.14.gr.it will reach from *Z.* to ♋. the interſection of the *Tropicke* of ♋ with the South part of the *Meridian*, but if the ſemidiameter *Z.S.* be placed over in the *Sine Complement.B.*viz.37.gr.30.m.& then the parallell Sine of *B.*viz.52.gr.30.m.being taken it will reach from *Z* to V.the other interſection of the *Tropicke* of 69 with the *Meridian* below the Pole, the Middle betweene this V.and 69. will bee at 1. which is the Center of that *Tropicke*: In like manner may be found the interſections, and *Centers* of the other parallels with the *Meridians*,and ſo may be deſcribed.

2. To deſcribe the houre lines

Secondly,ſeeing the Lat.is 51.gr.30.take the Semidiameter *Z S.*and fit it over in the *Sine Complement* of it, viz. 38.gr.30. then the parallell ſine of 51. gr. 30.m. will reach from *Z.* to *T.*the center of the houre of 6. *E P W.* but if the *Radius Z S.* be fitted over in the *Sine Complement* of halfe 38.gr. 30.viz.70.gr.45.m. and the parallell ſine of halfe 38. gr.30.viz. 19.gr. 15.m.be taken, it will reach from *Z.*to *P.* the *Pole*,then upon *T.* erect a perpendicular to the line *P T.*viz.2. *T.*10. which ſhall ſerve for the finding of the Centers of the *Meridians*,or houre Circles paſſing through the *Pole P.* now ſeeing that *T P.*is the neereſt diſtance in the right line 2.10.unto *P.*the right line *P.T.*ſhall be *Radius*, to a Circle, and the line 2.*T.*10. ſhal be a Tangent line to that Circle.Now the *Radius* of a Circle being knowne,the Tangent of any Angle,or Arke, may be alſo knowne, according to the Naturall projection and congruity of lines,but becauſe in this firſt direction we would apply it ſoly to the *Sector*: the center of the *Meridians* or houres may be had by the helpe of the Sines thereon thus.

Conſider what houre, or *Meridian circle* from the houre of 6.viz. *E,P,W.* you would diſcribe,for then if the *Radius P,T.* be fitted over in the *Sine complement* of it and the parallell *Sine* of the houre Angle Taken, it will ſhew from *T*, in the line 2.10. the center of that *Meridian*,or houre circle: ſo if the houre circle of 5. or 7. were

to

to be described, whose houre Angle at *P*, the Pole is 15. gr. fit the *Radius* or semediameter *T*, *P*. over in the Sine complement of it viz. 75.gr. for then the Sine perallell of 15.gr. being taken will reach from *T*, to 5. and from *T*, to 7, the Center of the houre circles of 5 and 7. If therefore one foote of the Cumpasses be placed in 5. and then extended to *P*. the Pole, you may describe the houre Circle of 5. and placed in 7. you may draw the houre Circle of 7. and so may be described the rest of the *Meridians*. and houre Circles.

Thirdly, to describe the *Ecliptick*, consider the distances betweene the *Zenith Z*. and the Tropicks of ♈. and ♑. according to the former Lat. of 51.gr. 30. which will be *Z*, ♈ 75.gr. and *Z*. ♋. 28.gr. then take the semideameter *Z*, *S*. and fit it over in the *Sine* of those Arkes, then the parallell *Sines* of the Complements of those Arkes will shew from *Z*. the distances of the Centers of these Tropicall points, so the Center of the Southerne semicircle of the *Ecliptick*, will be neare the Pole *P*, viz. at ♈. and the Center of the Northerne semicircle of the *Ecliptick* will be below the Pole at ♋. Therefore placing one foote of the Cumpasses in ♋. below the Pole, and extending the other foote to ♋. above the *Pole* you may describe the semicircle *E*, ♋. *W*. and placing one foote in ♈. neare the *Pole*, you may describe the semicircle, *E*, ♈, *W*.

3 To describe and divide the Ecliptick

Now for the dividing of the *Ecliptick*; this Mr. *Gunter* delivers so obstrusly in his 66, page of the Sector. That if a man had not more fundamentall Mathematicall Doctrine, then his Booke teacheth, he should never attaine unto it: Consider therefore first, what right Angle Triangles there are made by this *Ecliptick*, *Equator* and *Meridians*, viz, ♈ B ♌. or ♈ *B* ♉: ♈ *R* ♒. or ♈ *R* ♊, &c. and get the *right ascention* of these Arkes of the *Ecliptick* hat you intend to divide, so ♈, *B*. is the *right ascention* of the Arkes ♈, ♉, and ♈, ♌. and ♈, *R*. is the Right ascention of Arkes ♈, ♊, and ♈, ♒, from which ground the Table *S*. is calculated according to the Arkes in the *Ecliptick* in the Table *R*. Now to finde the Centers of those *Meridians* which may divide the *Ecliptick* according to the

Right aſcenſion here calculated anſwerable to the Arkes of the *Eclipticke* from ♈ or ♎ it nothing differeth from the inſtruction of the deſcribing of the houre Circles, in the ſecond direction: for if I would interſect the *Eclipticke* in the beginning of ♉.♌.♐.or ♑. the diſtance of either of thoſe ſinges from ♈ or ♎ is 30.gr.againſt which in the Table, *S.* is 27.gr.54.m. Now if the ſemidiamiter *P T.* be fitted over in the *ſine Complement* of this 27.gr.54.m.viz.68.gr.6.m.and then the parallell *ſine* of 27.gr.54.m.being taken it wil reach frō *T.* to 30.in the line 2. *T.*10. if therefore one foote of the Compaſſes bee placed in 30. towards 10. and the other foote extended to *P.* you may interſect the *Eclipticke* in ♉. and ♌. and then the Compaſſes placed in the other 30.you may interſect the other part of the *Eclipticke* in ♐ and ♑. and ſo may you divide the reſt of the *Eclipticke*.

R.	*S.*
5	4.45
10	9.11
15	13.48
20	18.27
25	23.09
30	27.54
35	32.42
40	37.35
45	42.31
50	47.33
55	52.38
60	57.48
65	63.03
70	68.21
75	73.43
80	79.07
85	84.32
90	90.00

Of the making of the Horizontall Quadrant Geometrically.

1. *Firſt*, having diſcribed a *Cirrle* at pleaſure as before, *E.S. W.N.* draw a line to paſſe by the center as *S.N.* and croſſe it at right Angles, with the line *E.W.* in *Z.* then let the *ſemcircles W S E* and *W N E.* bee divided from *W.* each of them into 180.gr.or rather upon *E.* wee may diſcribe a *Quadrant* at pleaſure, as *C D.* and augmenting it unto *ω*, divide the *Quadrant D C.* from *D.* into the uſuall diviſions of a *Quadrant*, and ſo from *D.* unto *ω*, inſert or protract the ſame diviſions, then having conſidered as before

fore the *Latitude* of the place, and distance of the parallels from *Z.* the *Zenith*, towards *S.* the *South*, and also towards *N.* the *North*, in the *Meridian* as in the former Table there is specified. Account the distance of the parallels from the *Zenith* towards *S.* the *South*, in the semicircle *W S E.* but those towards *N* the *North*, in the semicircle *W N E.* from *W.* so supposing the Latitude as before to bee 51.gr.30.m. the distance betweene the *Zenith* & the Tropicke of 69. towards the *South*, is 28.gr. which account from *W.* to *F.* but rather halfe of it from *D.* to *F.* then consider the distance betweene the Zenith and the other part beyond the *Pole*, viz.105. gr. number this from *W.* to *G.* but rather halfe uf it from *D.* to *G.* and laying a ruler upon *E.F.* and *E.G.* the *Meridian A B.* may be intersected in 69. and *V.* the middle, betweene which will be at 1. the Center of the Tropicke: in like manner the distance of the *Æquator* from the Zenith towards the South is 51.gr 30. reckon it from *W.* to *H.* or halfe of it from *D.* to *H.* but the distance of the *Æquater* from the Zenith towards the *North* beyond the *Pole* is 128. gr. 30.m. which I account from *W.* to *I.* or halfe of it from *D.* to *I*, then laying a ruler upon *E.H.* and *E.I.* the *Meridian A B.* may be intersected in *Q* and ϒ. the halfe distance betweene *Q* and ϒ. will be at 2. the Center of the *Æquater*: In like manner may the *Meridian A B.* bee divided into any of the rest of the divisions, and the parallels also discribed: But if a ruler be fastned to move upon *E.* then may you softly move the ruler from *D.* towards *ω.* and as it passet by the degrees according to the Colume *B.* of the Tables following, beginnig at the bottome, so the edge of the ruler shall shew the intersections that the parallels of declination betweene the Tropickes do make, with the *Meridian Z. S.* then move the *Ruler* softly along from *D.* towards *C.* as it passeth by the degrees in the Colume *G.* beginning at the bottome, so the edge of the *Ruler* shall intersect the *Meridian A.B.* in the Centers of those parallels.

1 To describe the parallels.

Secoudly, account the *Latitude* from *D* to *M.* and halfe the Complement of the Lat. from *D* to *R.* and laying a

2

ruler upon E M. and E R. the *Meridian*, S N. ſhall be interſected in T. and P. P. repreſenting the Pole of the world, and T the center of the houre of 6. then unto the line T P. upon the point T. erect a *perpendicular* 2. 10. and according to the ſemidiameter P T. deſcribe a ſemicircle a T C. divide the *Quadrants* T a and T C. from T. each of them into 90. gr. then lay a ruler upon P. and the ſeverall houre Arkes in the *Quadrants*, T a. and T C. interſect the line 2. T. 10. in the houre points, 2. 3. 4. 5. 7. 8. 9. 10. &c. then placing the Compaſſes in T. and extending the other foote to P. you may diſcribe the houre Circle of 6. but placing it in 5. and extended to P. you may diſcribe the houre Circle of 5. the ſame extent placed in 7. will diſcribe the houre Circle of 7. and ſo of the reſt: but if a ruler be faſtned to move on P. as it paſſeth by the degrees of the houres in the Quadrants from T. ſo the edge of the *Ruler* ſhall interſect the line 2. 10. in the Centers of thoſe houres from T.

2 To deſcribe the houre lines

3. To deſcribe and divide the Eclipticke.

Thirdly, to deſcribe the *Eclipticke*, conſider the Altitude of each Tropicke above the *Horizon*, according to the *Latitude* given, which was 51. gr. 30. m. So the Altitude of ♑. is 15. gr. and that of 69. is 62. gr. In the Quadrant D C. account thoſe degrees from D. viz. D ♑. and D ♋. lay a ruler upon E. and thoſe ſeverall poines, ſo may the Meridian S. N. be interſected in the points ♑. and 69. which are the Centers of the ſemicircles of the Eclipticke, therefore placing one foote of the Compaſſes in 69. below the Pole, and extending the other foote to 69. above the Pole, you may diſcribe the Northeren ſemicircle E. 69. W. and placing one foote of the Compaſſes in ♑. neere the Pole, and extending the other foote to ♑. neere S. you may deſcribe the *Southerne ſemicircle* E ♑ W. thoſe ſemicircles of the *Eclipticke* may bee divided *Geometrically*, without the helpe of the Table of *right aſcenſion*, but for more expedition we may uſe them thus. In the *Quadrants* T a. and T C. account the degrees of the *right aſcenſion* for ſuch diviſions of the *Eclipticke* as you intend to have, ſuppoſe the beginning of ♉ ♌ or ♏ ♒ the diſtances of the beginning of any of theſe ſignes, from the *Equinoctiall* poiuts are

equall

equall the one unto the other. viz. 30. gr which finde in the Table under *R.* ſo right againſt it under *S.* is 27. gr. 54. m. this account from *T.* towards *a.* and *C.* and laying a ruler upon *P.* and thoſe degrees interſect the Tangent line 2. 10. in 30. and then placing one foote of the Compaſſes in 30. towards 10. and extending the other foote to *P.* you may interſect the *Eclipticke* in the beginning of ♉. ♌. & ſo in ♐ ♓. the points required: In the likemanner you may divide the other part of the *Eclipticke*. So the Centers of the degrees of the Eclipticke may bee ſooner had, if a ruler bee placed upon *P.* and then to move thereon, Now as it paſſeth by the degrees of the Columes *1. 0.* in tha Tables following from *T.* in the ſeveral *Quadrants*: ſo the *Ruler* ſhall Interſect the line 2. 10. in the Centers of thoſe Arkes anſwerable to the columes *K N.* the degrees of the Ecliptick.

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3. By my Ring it may bee otherwiſe projected: *In which it exceeds any Inſtrument whatſoever for facility, and expedition, for where there is many proportionals required in any ſervice, there the uſe of the Ring is moſt excellently made manifeſt, they being inſtantly declared at once, which in ſome ſort I have delivered in the uſe of my Appendix upon plaine Triangles, or it may be drawne from that of Proportionating the Fort, to the Fort, or the Building, to the Building, Pag. the 2. and 3.*

LEt a Circle bee diſcribed according to any capacity, as before, and croſſed with *diametrall lines* at right Angles E. Z. Conſtruct.

E Z W. and *S Z N.* then take the semidiameter *E Z.* and divide it into 10. parts, & supdivide each of those parts into 30. or 100. (according to the capacity of the scale) as *A.* or more accurately according to the same *Radius* make a *diagonall* scale, then consider the distance of the *parallels* from the *Zenith* according to the *Latitude* you intend, as admit 51. gr. 30. m. to be the *Latitude* as before. Take the halfe of those distances (according to the first directions) by which is made the Colume *B.* which are the halfe distances of every degree betweene the *Tropickes* and the *Zenith*, then move the *Tangent* of 45. gr. unto the parts of the *Radius* or semidiameter, viz. 10000. in the *Circle* of *Numbers*, so right against the Tangent of any one of those degrees in the Colume *B.* in the moveable is the Number of equall parts in the fixed, by which is made the Colume *C.* (or they may be extracted out of the Tables of naturall *Tangents.*) Further if we consider the distance betweene the *Zenith* and the other intersections of those parallels, with the *Meridian* beyond the *Pole*, and take halfe of those distances wee may make the Colume *D.* then moving the moveable softly along, as the *Tangent* of any degree of the Colume *D.* in the moveable, passeth by the parts of the scall, viz. 10000. in the fixed (on the Circle of Numbers) so the *Tangent* of 45. gr. in the moveable, shall point out in the Circle of *Numbers*, the distance betweene *Z.* and those *parallels* beyond the *Pole.* From these directions are calculated the Numbers in the Colume *E.* or they may bee also taken from the Table of naturall *Tagents* as before: The Numbers of the Colume *C* and *E.* serve to finde the distances of the intersections of the *parallels* in the *Meridian* frō *Z.* & to discribe those parallels, note that at the bottome of the Columes *C.* & *E.* are the Numbers, 2493. & 13032. take 2493. from the *diagonall scale*, and protract it from *Z.* towards *S.* viz. at ♋. then take from the same scale also, 13032. and protract it from *Z.* to ♑. below *N.* divide the space betweene ♋. and ♑. into two equall parts which will be at 1. neere *P.* so have you the Center of the Tropicke of ♋. extend the *Compasses* therefore from 1. to ♋. then may you describe that *Tropicke*, viz. ♌. ♋. ♍. In like manner

Of the calculating of the Numbers, to describe the parallels.

manner may you draw the other *parallels*, but for more eaſe we may take halfe of the differences of the Numbers in the Colume *C* and the Colume *E*. and ſo may we have the Colume *F*. and then with greater expedition wee may protract the Centers of theſe *parallels*, from *Z*. for if 5269. which is at the bottome of the Colume *F*. (& betweene the former two Numbers) be taken from the ſcale, and protracted from *Z*. it will reach unto 1. the Center as before, and ſo any Number in the Colume *F*. is the diſtance of the *Centers* from *Z*. of his oppoſite Number in the Colume *B*. or *A*. by which Columes *C*. and *F*. you may deſcribe all the *parallels*, betweene the *Tropicks* from degree to degree.

But for more exactneſſe it were convenient to ſhew in what points of the *Arke ♑. E. ♈*. the parallels of *declination* interſect it, if truly deſcribed, and may be found by Page 57. of the *Appendix* upon the *Ring*, where is ſhewne to finde what Amplitude belongeth to the Sunnes declination, for any *Latitude* by moving the *Sine* of the Complement of the *Latitude*, viz. this of *London*, 38. gr. 30. m. unto the *ſine* of 90. in the fixed, ſo every degree of *declination* in the moveable, ſhall point out the *Amplitude* in the fixed by which is had the Numbers of the Colume *T*. the ſuns *Amplitude* belonging to the *declination* of the Colume *R*. Now if the *Quadrants E S. EN. WS. WN*. be divided from *E* & *W*. a ruler layed upon the Center *Z*. and to paſſe by the degrees in the ſeverall *Quadrants*, anſwerable to the degrees of the Colume *T*. the *Arkes ♑ ♈* and *♋*. ſhall be noted in ſuch points as the parallels of the *declination* ſhould interſect.

Secondly, move the *Tangent* of the *Latitude* in the moveable viz. 51 gr. 30 m. unto the former part of the *Radius* or ſcale. viz. 10000. in the *Circle of Numbers* in the fixed,

R.	*T.*
1	1.36
2	3.13
3	4.44
4	6.26
5	8.03
6	9.40
7	11.17
8	12.55
9	14.33
10	16.12
11	17.51
12	19.31
13	21.11
14	22.52
15	24.34
16	26.07
17	28.01
18	29.46
19	31.32
20	33.20
21	35.09
22	37.00
23	38.53
23.30	39.50

ſo the Tangent of 45.gr. in the movable ſhall point out 125717.in the Circle of Numbers in the fixed, which taken from the ſcale *A.*and protracted from *Z.* to *T.* it ſhall be the *Center* of the houre of 6. upon *T.* erect a perpendicular 2.*T.*10. ſerving for the Centers of the other houres: then move the Tangent of 45.gr. to the parts of the ſcale, viz.10000.in the *Circle of Numbers*, and conſider the diſtance betweene the *Zenith* and the Pole,viz.38.gr.30.m. the Tangent of halfe of it in the movable doth point out in the Circle of *Numbers* 34921.which taken alſo frō the diagonall ſcale,and protracted from *Z.*will reach to *P.* the Pole, through which all the houres muſt be drawne, and the *Centers* of which houres in the line 2.10. from *T.* may be had thus: which two numbers 125717.& 34921.I place over the Columes *H.*and *I.*

Of the calculating of the diſtances of the Centers of the houres

According to the diſtance *P.T.*make a ſcale *B.*(or rather a *diagonall ſcale*)to containe 10000. parts, then move the *Tangent* of 45.gr. to the parts of this ſcale in the *Circle of Numbers*, viz.10000. ſo every degree in the mouable amongſt the *Tangents* unto 45.gr.doth point out in the *Circle of Numbers*, the diſtances of the Centers of thoſe degrees from *T.*in the line 2.10. by which the Colume *H.* is made,then moving the moveable ſoftly along as the *Tangent* of any degree in the movable above 45.gr. paſſeth by the parts of the ſcale *B.* viz. 10000. in the *Circle of Numbers*, ſo the Tangent of 45.gr.in the moveable, paſſeth by the diſtance of the Centers of thoſe degrees from *T.*in the *Circle of Numbers* in the fixed, above 10000. by which is made up the reſt of the Colume *H.*viz.*I.*by helpe of which Colume *H.*and *I.*the houres may be thus drawne.

Of the deſcribing of the houres

Marke, what Numbers are againſt the houres in the Colume *H* and *I.* for if thoſe Numbers be taken from the ſcale *B.*and protracted from *T.* in the line 2.10. they ſhall be the Centers of thoſe houres:ſo in the Colume *H.*againſt the houre of 7.or 5. is 2679, which take from the ſcale *B.* and protract it from *T.*to 7. and from *T.*to 5. in the line 2.10.then placing one foote of the *Compaſſes* in 7.and extending the other foote to *P.* deſcribe the houre of 7. and one foote of the *Compaſſes* at the ſame extent being placed

ted in 5. shall also describe the houre of 5. In like manner may be protracted from *T*. out of the Colume *H*. the *Centers* of the other houres with their intermediats, and so also described.

But here note, that it were convenient to finde the Intersections of the *houre lines* (and their intermediate degrees) with the *Horizon* as before was delivered of the intersections of the parallels of *Declination* with the *Horizon*, and it may be drawne from my *Ring* thus. Move the Tangent of 45. gr. in the moveable unto the *fine* of the *Latitude*, viz. 51. gr. 30. m. in the fixed, then right against the Tangent of any degree from the houre of 6. in the fixed, is the Tangent of the degrees of the intersection of the houres, and the intermediate degrees with the *Horizon* in the moveable: from which direction is this Table drawne, and is onely for these degrees which intersect the *Horizon* in the *Calender*, but it might have beene extended further. The Application of which is thus: Account in the *Limbe* of the *Instrument* frō *E*. (the point of *East*,) any degree in the *Colume B*. and lay a Ruler thereto, and to the *Center Z*. so the intersection thereof in the *Horizon* shall shew the intersection that the *houre line*, or degree opposite thereunto in the *Colume A*. maketh with the *Horizon*. In like manner I might have delivered the Tables of the intersection of the houre lines with the parallels of *declination*, which would serve of great use in large *Instruments*, to describe these degrees, which are neere the houre of 12.

Of the finding the intersection of the houre with the Horizon.

A	*B*	*A*	*B*	*A*	*B*
1	1.10	12	15.12	23	28.29
2	2.33	13	16.26	24	29.38
3	3.50	14	17.40	25	30.48
4	5.16	15	18.54	26	31.56
5	6.23	16	20. 7	27	33. 4
6	7.39	17	21.20	28	34.12
7	8.55	18	22.33	29	35.19
8	10.11	19	23.45	30	36.25
19	11.27	20	24.57	31	37.21
10	12.42	21	26.08	32	38.36
11	13.57	22	27.18	33	39.41

Now to describe the *Ecliptick*, consider as before the hight of the *Tropicks* above the *Horizon*, in the *Latitude* given, viz. 51. gr, 30. m. so ♈ will be 15. above the *Horizon*, and ♋ will be 62. gr. high. Then move the *Tangent* of 45.

unto the parts of the ſcale *A.* in the *Circle of Numbers* in the fixed. viz. 10000. ſo right againſt the Tangent of 15. gr. in the moveable is 2679. the diſtance of the Center of the Southerne ſemicircle of the *Eclipticke* from *Z.* which I place in the Colume over *M.* and againſt ♈. then move the moveable ſoftly along untill the Tangent of 62 gr. bee right againſt 10000. in the *Circle of Numbers*, ſo the Tangent of 45. gr. in the moveable, ſhal point out 18807. on the *Circle of Numbers* in the fixed: The diſtance of the Center of the Northerne ſemicircle of the *Eclipticke*, from *Z.* which I place in the Colume over *P.* againſt ♎. if theſe numbers be taken from the ſcale *A.* and protracted from *Z.* they will reach from *Z.* to ♈. and from *Z.* to ♎, and ſo placing one foote of the *Compaſſes* in ♈. neere the *Pole*, and extending the other foote to ♈. neere *S.* you may deſcribe the Southerne ſemicircle of the *Eclipticke E.* ♈. *W.* and placing one foote of the *Compaſſes* in ♎. below the Pole, and extending the other foote to ♎. above the *Pole*: you may deſcribe the Northerne part of the *Eclipticke E*, ♎, *W.* and thoſe ſemicircles of the Eclipticke may be divided as followeth.

To deſcribe the Eclipticke

Move the Tangent of 45. unto the *Sine* of 66. and 30. ſo right againſt the Tangent of the degrees of the Sunnes Longitude in the *Eclipticke* in the moveable, are the Tangents of the degrees of the Sunnes *right aſcention* in the fixed, or they may be had by reſolving of a *Triangle*, in which there will be 90. ſeverall operations, but by this *Ring* they are given at one rectification, and onely by a glance of the eye: for proportionals either in *Sines* or *Tangents* are had by the *Ring*, with the ſame expedition that *Numbers* are had, As by the uſe of the *Circles* of *Sines* and *Tangents* upon the projection of this *Ring*, in diverſe particulars is declared in the *Appendix* upon the uſe of the *Ring*; and ſo according to the former Conſtruction is made the Columes *L.* and *O.* for 45. being brought to 66. gr. 30. m. as before, right againſt 10. gr. in the moveable, is 9. gr. 11. m. in the fixed, againſt 20. gr. in the moveable, is 18. gr. 28. m. in the fixed, and ſo of the reſt. Then move the Tangent of 45. gr. to the parts of the ſcale *B.* viz.

How to make the Table to divide the Eclipticke

10000.

10000. in the Circle of Numbers, ſo right againſt the Tangent of the Arkes in the Colume *L.* in the moveable are the diſtances of the Centers of thoſe Arks, from *T.* in the *Circle of Numbers* in the fixed, and ſo is made the Colume *M.*& if you move the moveable ſoftly along as the Tangent of any degree in the Colume *O.* paſſeth by 10000 the parts of the ſcale *B.*ſo the Tangent of 45.in the moveable, paſſeth by the diſtances of the Centers of thoſe degrees from *T.*in the Circle of Numbers in the fixed, by which is made the Colume *P.* or they may bee had from the Table of naturall Tangents.

To divide the Eclipticke.

*Then by the ſcale B.*protract the *Numbers,*out of the Colume *M.*and *P.*from *T.*in the line 2.10. for they ſhall bee the *Centers* of thoſe degrees of the *Eclipticke,* which are oppoſite unto them,viz.in the Columes *K.* and *N.* ſo if I would interſect the *Eclipticke,* in the beginning of ♉.♌.♏.or ♓.each being diſtant from ♈.30.gr. which I ſeeke in the Colume *K.*and finde right againſt it in the Colume *M.*5294. which I take from the ſcale B. and protract it from *T.*to 30.in the line 2.10. Now placing one foote of the *Compaſſes* in 30.next 10.and extending the other foote to *P.*the *Eclipticke* may be interſected in the points of ♉.and ♌.and placed in 30. towards 2.the ſame extent will Interſect the *Eclipticke* in ♏.and ♓. In like manner may the Centers of the reſt of the degrees of the *Eclipticke* be protracted in the line, 2.10. from *T.* out of the Columes *M.*and *P.*and ſo all the *Eclipticke* divided from degree, to degree: but this may be otherwiſe done.

Beſides that which is delivered touching the drawing of the *Parallels, Eclipticke,*and *Houre lines,* there remaines yet how to put on the *Callender,*to graduate the *Index,*and to draw,and divide the line of *Shadowes.*

This may be eaſily done from the Table *R.*Calculated, and accommodated to that purpoſe for the yeare 1640,and may ſufficiently ſerve for many yeares after, without any ſenſible error.

Conſtruction.

Having divided the *Quadrants,E.S.*and *E.N.*(as before into the uſuall degrees of a *Quadrant,*) lay a ruler upon the

How to inscribe the Callender

the Center *Z.* and account the degrees from the point *E.* in the *Quadrant* towards *N.* and *S.* out of the Table *R.* according to the severall Columes of the Table *R.* and Intersect the *Quadrants*, with small short lines, so shall the Arke of the *Horizon* of the *Instrument* from *E.* be divided into the usuall dayes of the *Month*, which is the *Callender* and the beginning of these divisions, may be at the 10. of *March*, and so going on to the 11. of *June*, and then againe to begin from the 10. of *March*, and go on unto the 10. of *December*, and these dayes may bee noted upon the inside of the *Horizontall* Arke with short lines from *E.* as before, and at every *Month* may bee placed a representative letter for that *Month*, and every 10. and 5. day of every *Month*, may bee noted with a small stroke somewhat longer then the rest, to helpe the memory the readier to number. In like manner may the rest of the dayes of the *Calender* be intersected in the out side of the *Horizontall* Arke, towards the *Limbe*, beginning at the 13. of *September*, and so going on to the 11. of *June*, then againe from the 13. of *September*, and going on unto the 10. of *December*, and these *Months* may bee also noted with significant letters, appropriate to each *Month*, and each 10. and 15. day of the *Month*, may be also denoted as before, with a stroke somewhat longer than the rest, according to the Scheme against Page the 1.

How to graduate the Index for the Instrument.

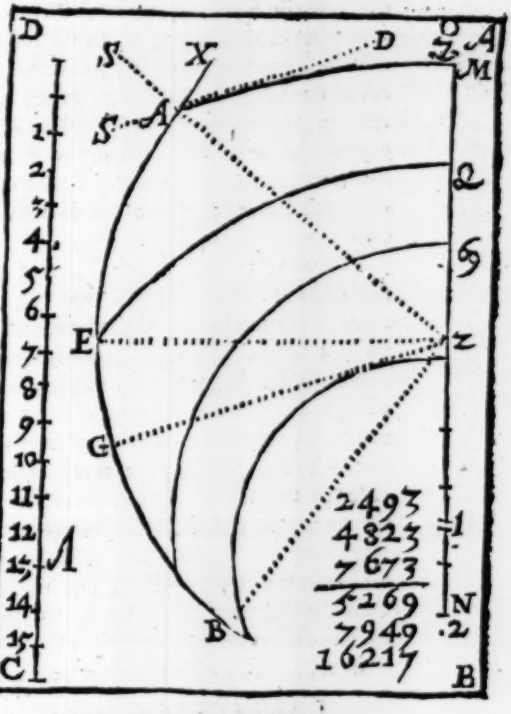
Let the *Index* be equall to the semidiameter, *Z.E.* and then may it bee divided out of the *Table Q.* by the helpe of the scale *A.* beginning at the Center: the *Index* being diuided, and placed on the Center of the *Instrument* at *Z.* it shall helpe to put on, and divide the line of *shadowes.* as followeth.

Lay the edge of the *Index* to *A.* in the *Limbe* which is neere the 10. of *December*, and move it to any degree in the

the *Table S.* and account the like degree in the *Index*, and then make a marke upon the plaine of the *Instrument* where that degree toucheth, and so goe on from point to point, untill the whole line bee described and divided, according to the *Table S.* This line might bee placed betweene the *Calender* and the *Limbe*, or in a *Quadrant*, &c. But I have caused it to bee described as is seene upon the *Scheme* against Page the 1. for expedition and conveniency. ☞

Now if any desire to inlarge the *Instrument* to a proportion assigned, or to describe the *Trapezi-all* forme in the greatest proportion upon a plaine given: without curiosity, it may bee done thus.

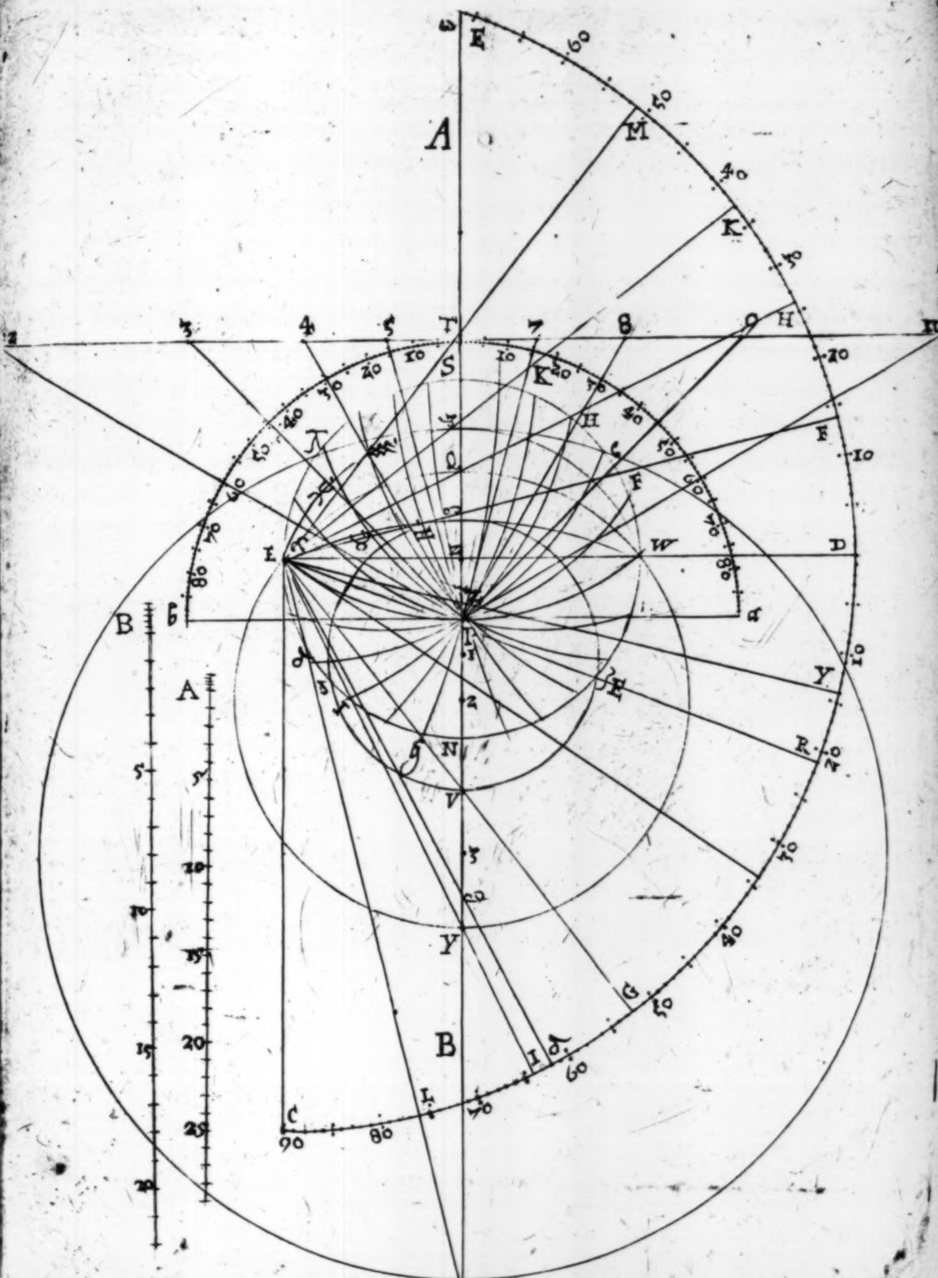
Let *A. B. C. D.* be a plaine; divide the length *A. B.* within halfe an Inch of the higher end, and an Inch of the lower end, in to 3. equall parts which suppose the line *M. N.* then divide each part into halfe so the line *M. N.* shall bee divided into 6. equall parts, the middle of which will bee at *Z.* Then take 4. of these parts for *Radius*, and on *Z.* describe the obscure *Arke*, *A. E. B.* and upon *Z.* erect a perpendicular to the line *M. N.* to cut the Arke *A. B.* in *E.* now from *E.* to *A.* protract 40. gr. and from



from *E.* to *B.* protract 50. gr. ſo the Angle *E. Z. M.* ſhall be 90. and alſo *A. Z. B.* ſhall be 90.. Now having made a ſcale of *Z. E.* like to the ſcale *A.* according to the former directions) then out of the Colume *C.* and by helpe of the ſaid ſcale *A.* from *Z.* you may protract *Z.* ♋. 2493. *Z. Q.* 4823. and *Z.* ♍ 7673. and from the Colume *F.* you may protract the diſtances of the *Centers* of thoſe interſections from *Z.* viz. *Z.* 1. 5269. *Z.* 2. 7949. and *Z.* 3. 16217. and ſo placing the Compaſſe in theſe *Centers*, you may deſcribe the *Equator*, and both *Tropicks*. But if *Z. M.* and *Z. N.* be divided according to the ſcale *A.* then from *Z.* you may account the interſections of the parallels, and diſtances of the Centers, and ſo deſcribe the parallels with greater expedition, and ſo ſhall you have the *Scheme* or *Trapeziall* forme of the *Inſtrument*, *B. A.* ♍. ♋. and may bee finiſhed according to that againſt Page the 1. by the *Tables* and directions here calculated, and delivered to that end.

Now to augment the *Inſtrument* to any proportion aſſigned, as if betweene the *Tropickes* were ſuppoſed to bee 10. *Inches*, the *Radius* might be found out, or if the *Radius* were 4. foote, (which is according to mine owne *Inſtrument*:) what diſtance might there bee betweene the *Tropickes*: the proportion would be as 516. to 1000. ſo the breadth to the ſcale, or as 1000. to 516. ſo the ſcale to the breadth: therefore by the *Ring*, bring 516. in the moveable, to 1000. in the fixed, ſo right againſt any *Radius* in the fixed, is the diſtance betweene the *Tropickes* in the *Moveable*, or againſt the diſtance aſſigned for the *Tropickes* in the *Moveable*, is the meaſure of the *Radius* or *Scale*, in the *fixed*: So if ♍. ♋. be allotted to be 10. *Inches*, for the diſtance betweene the *Tropickes*, the *Scale*, or *Radius*, of the *Inſtrument* ſhould be $19\frac{4}{10}$. fere: but if the ſcale or *Radius* were 4. foote, or 48. *Inches*, then the diſtance betweene the *Tropickes* of ♍, and ♋. will be neere $24\frac{77}{100}$. *Inches*. Thus for the making of the *Inſtrument*, the deſcription of which followeth.

The



The Deſcription of the Horizontall Quadrant.

THe forme of this *Inſtrument* is like a mixt *Trapezia*, as appeares againſt Page. 1. where of two ſides are right, and the other two ſides are *Circular*, which falleth out to bee ſo from the nature of the *Projection*, and that part which I have thought moſt convenient for uſe, and is fully ſufficient for that which I have deliuered upon it; and may be made of any plaine *Materiall*, but fitteſt in *Braſſe*, or *Silver*: the ſeverall parts of which *Inſtrument* are five, viz. the *Backe*, the *Face*, the *Sights*, the *Index*, and the diviſions, and lines projected on the *Face*.

Firſt, the Backe of the Inſtrument, is a part of *Gemma Friſius* projection, whoſe particular deſcription and admirable uſe I intend here after as God ſhall give life and Ability to make manifeſt. 1.

Secondly, the face of the Inſtrument, is that upon which the *Index*, and ſights are placed on. 2.

Thirdly, the Sights are the ſmall peeces of *Braſſe* in which there is in each a little hole to looke through, or the ſunne beames to paſſe through, and are faſtned upon the *Face* of the *Inſtrument*; one of which Sights is neere the *Center* of the *Inſtrument*, and the other is neere the *Circumference* thereof. 3.

Fourthly, the Index, is the movable peece of braſſe, faſtned at the *Center*, upon which alſo two other ſights may be placed, the edge of this *Index* is divided and noted thus. 10. 20. 30. 40. 50. 60. 70. 80. 90. which are called the degrees of the *Index*, and there is adjoyned unto it three ſmall plates to be rectified as occaſion requires, one of which is called the *Axis*, and the other two are perpendicu lars. 4.

5 *Fiftly*, the lines deſcribed on the *Face* of the *Quadrant* are ſixfold.

Viz.
- *The Limbe and its Parallels.*
- *The Kalender and its diviſions.*
- *The Æquator and its Parallels.*
- *The Eclipticke and its diviſions.*
- *The Houre lines and their intermediates.*
- *The line of Shadowes and its diviſions.*

1. *Firſt, the Limbe* is the outmoſt *Circle*, which is divided into 140.gr. and noted at every 10.degree thus, 10.20.30. 40.50.60.70.80.90. and each of theſe degrees is divided into parts according to the Capacity of a degree in the *Inſtrument*.

2. *Secondly*, the next parallell line to the Limbe is the *Horizon* or *Kalender*, which is noted with letters thus, *I.A. S.O. N.D. I.F. M.A. M.I.* of which *I.* in the firſt place ſtands for *Iuly*, *A.* for *Auguſt*, *S.* for *September*, *O.* for *October*. &c. then againe on the inſide, *I.* ſtands for *Ianuary*, *F.* for *February*, &c. each letter repreſenting its *Month*, and each of thoſe *Months* is divided into dayes by ſmall ſhort lines, whereof the 10. and 15. day of every *Month* is ſignified by *Numbers*, or elſe by a line ſomewhat longer then any of the others, to helpe the *memory* the readier to *Number*, and for more promptneſſe of finding the day of the *Month*, in the *Kalender* as occaſion requireth.

3. *Thirdly*, *The Equater* is that line that meeteth with the tenth of *March*, and the thirteenth of *September* in the *Kalender*, and is divided into degrees, and numbred thus, 10.20.30.40.50.60.70.80.90. and the parallels to the *Equator* are theſe lines which are on each ſide of it, every 5. degree of which being noted thus, 5.10.15.20. the outmoſt of thoſe *Parallels* on each ſide of the *Equator* are the two *Tropickes* that which is neareſt the *Center*, is called the *Tropicke* of ♋, and that which is fartheſt of, is called the *Tropicke* of ♑, thoſe two *Tropicks*, the *Kalender*, and the houre of 12. comprehend the whole *Projection*: and here note farther that theſe parallels are called

parallels

parallels of the day of the *Moneth*, as well as the parallels of the Sunnes *Declination*, according as they ſhall be vſed, and farther below the *Tropicke* of *Cancer* is a graduation of the common houres of a *Horizontall* Dyall; ſome vſe of whſch is ſhowne, by pro. 36.

Fourthly, the Eclipticke on the inſtrument is repreſented by two quarters of the *Eclipticke* which croſſeth the former parallels, and meeteth with the *Equator*, in the *Horizon* or *Kalender*, in the former 10. of *March*, and 13. of *September*: that *Quarter* which is towards the *Center* of the *inſtrument*, ſerves for the *Northerne ſemicircle* of the *Eclipticke*, and that which is farther from the *Center* ſerves for the *Southerne ſemicircle* of the *Eclipticke*; & each of theſe *ſemicircles* is divided into the *Signes* of the *Zodiacke*, & characſtered accordingly thus, ♈.♉.♊.♋.♌.♍.♎.♏.♐.♑.♒.♓. Of which the firſt 6. *Signes* are called *Northerne ſignes* and are in the *Northerne ſemicircle*, & the other 6. *Southerne ſignes* & are in the *Southerne Semicircle*. And each of thoſe *ſignes* is divided into 30. gr. and if the *Inſtrument* be large, each of theſe degrees may be divided into 6. or 12. diviſions more, So every diviſion ſhall accordingly containe 10. or 5. Minuts. 4.

Fiftly, the houre lines are thoſe that croſſe the *Æquator* and his parallels, and are noted, or numbred in the *Tropicke* of ♋ with *numerall Characters* thus IIII. V. VI. VII. VIII. IX. X. XI. XII. And are the forenoone houre notes: thoſe hourelines ſerve alſo for the afternoone houres, and are noted likewiſe with *Arithmeticall* figures, for the houres in the afternoone thus, 1.2.3.4.5.6.7.8. each of thoſe houres is divided into 3. parts, each part being 20. minuts: and each of thoſe parts is ſubdivided againe into 5. parts, ſo that each part containeth 4. minutes, and ſo the whole houre is divided into 15. parts or degrees, each part or degree being 4. minuts as afore, and ſo the whole houre ſhall containe 60. minuts or parts: and here note that theſe *Houre circles* with their intermediates are alſo called *Meridians* or degrees of meaſure, and are *Numbred* by tens in the *Æquator*, from the meeting of the *Æquator* with the *Eclipticke*, as before thus, 5.

thus, 10.20.30.40.50.60.70.80.90.

Sixtly, the line of ſhadowes is that which makes a *ſpherical Equilaterall Triangle* upon the plaine of the *Inſtrument*, the baſis of which is the *Horiton*, or *Kalender* and one of whoſe legges is below the *Tropicke* of ♋ and the other croſſeth the *Tropicke* and parallels, and meeteth with the *Kalender* neere in the 10. of *December*: both of thoſe equall ſides are called the line of *ſhadowes*, and are divided alike into 10. vnequall diviſions, and each of thoſe diviſions againe is divided into 10 other diviſions, and againe each of them into other 10. (if the *Inſtument* be large.) The firſt Capitall 10. diviſions are noted with *Arithmeticall figures* thus, 1.2.3.4.5.6.7.8.9.10. of which 1. is at the very meeting of the two lines, not farre from the *Center*, which ſignifieth *Equall*: the figure of 2. *Double*: the figure of 3. *Triple*, the figure of 4. *Quadruple*: the figure of 5. *Quintuple*, *&c*, *Thus for the making, and deſcription of the Inſtrument, the uſe of it now followeth*,

Of

Of the Vſes of the Horizontall Quadrant, ſpecified in the *Index* or *Table*, formerly deliveted.

OF which ſome have relation to the obſervation or appearance of the *Sunne*, others without obſervation, or ſight of the *Sunne*.

The Vſes of theſe which are knowne without ſeeing the *Sunne*, are 30. of the ſaid *Index* or *Table*, as followeth, viz. the 2. 9. 10. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 23. 24. 25. 26. 27. 28. 29. 30. 32. 33. 35. 37. 38. 39. 40. 41. and 42. of which 13. of them will be ſhowne onely by knowing the day of the *Month*, viz. the 18. 33. 21. 19. 25. 24. 35. 2. 38. 37. 20. 41. and 42. as followeth.

The day of the Month knowne to finde.

1. The houre of Sunne rising, setting, and length of the day.
2. The Sunnes difference of Ascention.
3. The Sunnes Declination.
4. What dayes are alike in length, and what day the Sunne rising in the one, shall be the Sunne setting in the other.
5. The Sunnes place, or degree in the Ecliptieke.
6. The Sunnes right Ascention, and oblique Ascention.
7. The houre, and Altitude of the Sunnes comming East, or West.
8. The distance of the Sunnes rising, or setting, from the East, or West.
9. The height, or depression of the Sunne in the Meridian here, or for any Latitude.
10. The time of day breake, and end of twylight.
11. The inequality of time, betweene day breake, and Sunne rising.
12. The houre, and Altitude of the Sunnes comming upon any declining wall.
13. At what houre, and Altitude, the Sun must have to be opposite or perpendicular, to a declining wall.

First,

Firſt, to finde the time of Sunne riſing, or ſetting, and length of the day, for any day of the yeere. Pro. 1.

Seeke the day of the *Month* in the *Kalender*, and the *houre line* that meeteth therewith, ſheweth the time of *Sunne riſing, or ſetting*. *Conſtru. Elio. 1*

So if the day of the *Month* were the 13. of *October*, the parallell that meeteth therewith is the *houre*, viz. 7. of the clocke, at which time the Sun riſeth: the ſame *houre* is noted alſo with 5. which is ſ time of *Sun ſetting* that day, this doubled makes 10. the length of the day required. *Exam.*

Secondly, to finde the difference of Aſcention, for any day of the yeere. Pro. 2.

Marke what *Meridian* meeteth with the day of the *Month* in the *Kalender*: as ſuppoſe the day to be the former 13. of *October*, which is the *houre line* of 7. and 5. (as before) and account the Numbers of *Meridians* to the *houre* of 6. ſo have you 15. gr. or an *houre*, which is the difference of *Aſcention* for the 13. day of *October* required. *Conſtru. Elio. 2.*

Thirdly,

Pro. 3 Thirdly, to finde the Sunnes declination for any day.

Construction.3. *Marke* what parallell of *Declination* meeteth with the day of the *Month* in the *Kalender*, and account how many degrees it is from the *Equinoctiall*, so have you the *Sunnes Declination* for that day.

Exam. So if the day were the last of *August*, the parallell that meeteth therewith is the 5th. from the *Equator*, and somuch is the *Sunnes declination*, that day, viz. 5 gr. *North declination.*

Pro. 4. Fourthly, to finde what dayes in the yeare are alike in length, and what day the Sunne rising in the one, shall be the Sunne setting in the other.

Construction.4. *For the first*, note that the dayes betweene the 10th. of *December* and the 11th. of *June*, are dayes of Increase, and the rest are dayes of Decrease. Now right against any day of decrease in the *Kalender*, is the day of increase, which dayes are equall one to the other. So the 19. day of *May*, is against the 4. of *July*, at which time the *Sunne* riseth and setteth alike without sensible error,

Exam.

error, viz. 4. of the clocke, and therefore those dayes are of equall length, and so of others.

For the second, to finde what day the sunne rising in the one, shall be the sunne setting in the other.

Admit the day to be the 18th. of *February* and according to the first pro. finde the time of *Sunne rising*, which is at 40. m. after 6. of the clocke for that day, and the setting 20. m, after 5. then marke what day of the *Month* the *houre* line of 20 m, after 5. in the forenoone, meeteth with the *Kalender*, which will be the 23. of *August*, so the 18th. day of *February* the Sun did set at the same houre that it did rise, the 23. day of *August*. *Exam. Construct. 5.*

Fiftly, to finde the sunnes place, or degree, for any day of the yeere. *Pro. 5*

Note where the parallel of the day of the *Month* crosseth the *Ecliptick*, that is the *Sunnes* place. So the former parallell of the 13th. of *October* meeteth with the *Ecliptick* in the beginning of ♏, and ♐, but which of these is the *Sunnes* place, the quarter of the yeare may easily tell you, viz. ♏ which is the *Sunnes* place or the degree in the *Ecliptick* for that day. *Construct. 6. Exam.*

Pro.6. *Sixtly, to finde the Sunnes right aſcention, and oblique aſcention at any time.*

Conſtruction.7

Conſider what *Meridean* meeteth with the Sunnes place in the *Eclipticke* for the day given, and marke the number of *Meridians* in the *Equator* (for the *Meridians* are numbred in the *Equator*, as is ſayd before in the deſcription) ſo have you the Sunnes right *Aſcention:* but here note that the degrees in the *Eclipticke* are numbred forward and backeward in the *Eclipticke* unto 360. gr. upon this *Inſtrument:* ſo are the right *Aſcentions* of thoſe degrees alſo numbred forward and backward in the *Æquator*: for the right aſcention of any degree in the *Eclipticke*, is that degree of the *Æquator* which is oppoſite unto it, (the ſucceſſion of the *ſignes* conſidered) ſo if the *Sun* were in the beginning of ♏, the right *Aſcention* is neere 208. degrees; for the *Meridian* that paſſeth by the beginning of ♏, is accounted in the *Equator* from ♈, and is within 6.m, of 28. gr. *Now* the right *Aſcention* of ♋, is 90. gr. and the beginning the of ♎, is 180. gr. and from the beginning of ♎, to the beginning ♏, is within 6.m, of 28. gr. as before, all is which put together makes neere 208. gr. the right *Aſcention* of the *Sun* the 13th. day of *October*.

To

To find the Sunnes Oblique Aſcention at any time.

Note that the difference of *Aſcention*, is the difference alwayes betweene the right *Aſcention* of the *Sun*, and the oblique *Aſcention* thereof: therfore the right *Aſcention* known by the laſt direction, & the difference of *Aſcention* by the ſecond direction, the oblique *Aſcention* is eaſily had, by *Addition*, or *ſubſtraction* thus. If the *Sun* be in a *Southerne ſigne* then the *oblique Aſcention*, is greater then the right *Aſcention*, by ſo much as the difference of *Aſcention* comes to: but if the *Sun* be in a *Northerne ſigne*, *the oblique Aſcention* is ſo much leſſe: which difference of *Aſcention* as before by the 2 *Pro*: for the ſaid 13th. of *October* was 15. gr. this ad unto the right *Aſcention* of the beginning of ♏, viz. 208. gr. makes 223. gr. the *Suns oblique Aſcention* for the beginning of ♏, on the 13th. day of *October*; but if the *Sun* had beene in the beginning of ♉, the *oblique aſcention* would have beene onely neere 13. gr. viz. 12. gr. 54. m. *Conſtruc. 8.*

Seventhly, to find the ſuns Altitude, and houre of the ſuns comming Eaſt, or Weſt, any day of the yeare above the Horizon. *Pro. 7.*

Here note that this *Propoſition* holds in uſe *Conſtruc. 9.*

onely for that time of the *Suns* being in the *Northerne signes* that is from the 10th. of *March* to the 13th. of *September*: therefore lay the *Index* to the *East*, or *Æquinoctiall point* noted with *E.* or 40. & 50. in the *Limbe*: so have you instantly at once without farther rectification both the *Altitude and houre* of the *Suns* comming *East* or *West*, above the *Horizon* for all or any of the dayes above specified: so the parallel of any day of the *Moneth* meeting with the edge of the *Index* gives the Suns *Altitude* in the *Index*, and the *Meridian* meeting therewith shewes the *houre*.

Exam. So if it were the second of *May*, or the 22. of *July*, the parallel belonging to those daies meetes with the *Index* neere about, 23. gr. 17. m, and there also meetes with that point, the *houre line* of 7, and 5. which sheweth that when the *Sun* is 23. gr. 17. m, high either upon the second of *May* or the 22. of *July*; then the *Sun* will be due *East* or *West*, and that will happen to be at 7 of the clocke in the forenoone, and 5. of the clocke in the afternoone.

Pro. 8. *Eightly, to find the distance of the Suns rising, or setting, any day of the yeare, from the East, or West, called the Suns Amplitude.*

Construction, 12. *Lay* the *Index* to the day of the *Moneth*, for the time

time given, & the edge of it in the *Limbe* of the *Instrument* ſhall ſhew the *Amplitude* required.

So if the day were the 13th. of *October* the number of degrees from the points of *Eaſt*, noted with 40. 50. unto the *Index* is 18. gr. 40. m. which is the *Suns Amplitude* for the given day, viz. the 13th. day of *October*. *Exam.*

Ninthly, to know the ſuns Meridionall Altitude, or the ſuns depreſſion under the Horizon, at Midnight here, or in any Latitude, for any day in the yeare. *Pro.* 9

Lay the Index unto the *houre* of 12, and where the parallel of the day of the *Moneth* meeteth ỳ therewith ſhal be the *Suns Meridionall Altitude*. *Conſtructio.* 11.

So if it were the 13th. day of *October*, as before, the parallell, for that day is 11. gr. and a halfe from the *Equator South*: this croſſeth the *Index* in 27. gr. which is the Sunnes *Meridionall Altitude* that day. Now for the Sunnes depreſſion at midnight, here is to be noted, that any degree of the *Eclipticke* is at any time ſo much below the *Horizon*, as his oppoſite degree in the *Eclipticke*, is above the *Horizon* at the ſame time. *Exam.*

Therefore where the contrary parallell of the *Sunne* viz. 11. gr. and a halfe *North*, meeteth with *Conſtruction.* 12.

the *Index* in the houre of 12. that ſhall bee the *Sunnes Meridionall depreſſion* at midnight, the ſaid 13th. day of *October*.

Pro. 10. *Tenthly, to finde the time of day-breake, and end of twy-light, with the Poſition of the ſunne under the Horizon for any time.*

This propoſition, hath reference to the Sunnes depreſſion under the *Horizon*, for it is ſaid to bee day breake or twi-light to end, when the *Sun* is, 18. gr. under the *Horizon:* therefore the Conſtruction in this will be thus.

Conſtructio. 13. Account 18. gr. on the *Index* then move the *Index* untill that degree meete with the Contrarie parallel of *Declination* for the day given, ſo the *Meridian* or *Houre-line* that meeteth therewith ſhall bee the *houre* of day breake required.

Exam. So if the day were the 10. of *Aprill*, the parallel of *Declination* for that day is *North* 11. gr. and a halfe which I ſeeke out one the other ſide of the *Æquator* viz. 11. gr. and a halfe *South Declination*, and Marke where the 18th. gr. of the *Index* meeteth therewith, for there alſo is the *houre* of day breake *viz.* with in 20. m. of 3. in the Morning, and 20. m. paſt 9. for the end of *twi-light* the ſayd 10th. of *Aprill*, alſo the *Index* in the *Horizon* at that Inſtant

ſhew-

ſheweth the poſition of the *Sun* under the *Horizon* viz. neere 48 gr. 10. m. to the *North* of the *Eaſt*: but if the day had beene the 13th of *October* the houre of *day breake* had beene 2 minuts before 5. and *twi-light* would have ended 2. m. after 7.

Eleventhly, to finde the inequalitie of time, betweene day breake and Sun riſing, for any day of the yeare aſsigned. Pro. 11.

By the firſt *Conſtruction*, for the dayes given finde the time of *Sun riſing*, and by the former 13th Conſtruction the *houre* and time of *day breake* belonging to thoſe dayes: then compare the time betweene the *Sun riſing*, *and day breake* of the one, with that of the other, ſo the difference of thoſe two, ſhall bee the difference of time required. *Conſtruct.* 14

Example.

			H. M.		H. M.	
So on the tenth of	*March* the	*Sun riſing is at*	6. 00	*The time betweene day breake and Sun riſing is.*	2. 0	the difference is, 12. m.
		day breake is at	4. 08			
	Decemb. the	*Sun riſing is at*	8. 12		1. 12	the difference 1. h. 22. m.
		day breake, is at	6. 00			
	May the	*Sun riſing is at*	4. 11		3. 34	
		day breake, at	12, 37			

So the difference of time betweene *day breake and Sunne riſing* the 10th of *December* is neere a quarter

quarter of an *houre* longer then that of the 10th of *March*; but more then an *houre* and halfe longer betweene *day breake, and Sun rising* the 10th of *May*, then the 10th of *March*.

Pro. 12. ## *Twelfely to finde the houre, and Altitude of the Sunnes comming upon a Declining wall any day of the yeare.*

☞ *Seeing the declinations of Plaines, or Walls*, are accounted from the points of *East* or *West* in the *Horizon*, as the *Sunnes Amplitude* is the numbering of them therefore shall bee alike, in the *Limbe* of the *Instrument*. Now admit the *Declination* of a *Plaine* or *Wall*, to be 22. gr. the opperation would be thus. The *Index* being set thereto, you may instantly see at what *houre* the *Sunne* will come upon the *Plaine*, for any day in the yeare; for where the parallell of the day of the *Moneth* crosseth the *Index* amongst the *houre-lines*, (which *Index* represents the *Plaine*) that is the *houre* of the *Suns* comming upon the *Plaine* and the degrees in the *Index* gives the *Sunnes Altitude*. So if the Sunne were in the *Tropicke* of ♋ the *Tropicke* meeteth with the *Index* almost within 5 m. of 9 in the Morning, and at that time the *Sunne* commeth upon the *Plaine*, and there the *Tropicke* cuts also the *Index* in 45. gr. 40. m.

Construction. 15.

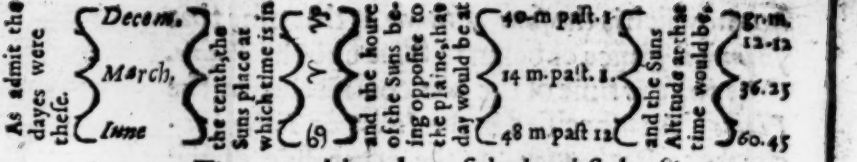
Examp.

40.m. which is the *ſuns Altitude* at that time that ỳ *Sun* wil glance or begin to ſhine upō the *Plaine*.

As for the time of the *ſuns* continuance on the *Plaine* (as is ſpecified in the *Index* or *Table*) account the *Declination*, on the other ſide of the *Eaſt* point, and lay the *Index* thereto, ſo the edge of it in the *Tropicke* of ♋, will point out at what houre the *Sun* goes of the *Plaine* viz. at 6. of the clock & 38.m, neere; if the *declination* were *Weſt*, (as here it is ſuppoſed) which added to the time of the *ſuns* cōming on the *Plaine*, makes 9. *houres* 33.m, & ſo long the *ſun* ſhines on the *Plaine*.

Thirteenthly, to finde at what houre, and Altitude the ſun muſt have to be oppoſite, or perpendicular to a declining Plaine, any day in the yeere. Pro. 13.

Let a Plaine decline from the *Eaſt* point towards the *South* 22. gr. account this in the *Limbe* from the *houre* of 12. and lay the *Index* thereto, ſo the parallell that croſſeth the *Index*, doth ſhew the *Sunnes Altitude*, and the *Meridian* meeting therewith, gives the *houre*, at which time the *Sun* will be oppoſite to the *Plaine*; ſo have you at one inſtant for every day in the yeare, at what *houre* and *Altitude*, the *Sunne* will bee oppoſite to the *Plaine*. *Example.* *Conſtruct.* 10.16.



Thus touching the resolution of the former 13 uses of the aforesaid *Table*, or *Index* which had reference only to the knowledge of the day of the *Month*, there are 13. other *uses* of the foresaid *Index*, or *Table* viz. the 10.12.32.39.40.23.17.16.26.27.28.29.30. Which have no dependance upon the sight of the *Sun*, of which the 6 first are resolued, only by knowing the day of the *Month*, and the other 7. are as followeth.

viz by knowing the day of the Month to finde.

1. *At what houre the shadow of an Altitude is equall, double, triple, &c. unto it.*
2. *At any houre and Altitude of the Sun, or Azimuth, what proportion shadowes have to their bodies.*
3. *The houre of the day agreeable to any Altitude, or Azimuth.*
4. *The Suns depression and Azimuth at any houre of the night Assigned.*
5. *The houre of the day to our Antipodes, by supposing the Suns Depression under the Horizon.*
6. *At what houre in any day the Suns Azimuth and Altitude will be equall, and how much the Altitude and Azimuth will be.*

7. *When*

To finde.

7. *What number of dayes will make the day an houre longer, or ſhorter at any time.*
8. *The inequallitie of time in equall moneths, or equall number of dayes.*
9. *The degree of the Æquator in the Horizon, by ſuppoſing any degree of the Eclipticke in the Horizon.*
10. *The degree of the Eclipticke in the Horizon by ſuppoſing the degree of the Equator in the Horizon.*
11. *The degree of Medium Cœli, or the degree of the Eclipticke in the Meridian, by ſuppoſing the degree of the Eclipticke in the Horizon, vel contra.*
12. *The Horoſcope, or the degree aſcendant, or deſcendant, and the Nonageſſima degree at any houre.*
13. *What Angle the Eclipticke makes with the Horizon, or the Altitude of the Nonageſſima degree, & what Azimuth it is in at any houre.*

Firſt, to finde the Proportion of ſhadowes to their Altitudes at any time. Pro. 14.

As if it were required the 20 of *Aprill*, at what houre of the day, and how high the *Sun* muſt be either in the *forenoone* or *afternoone*, that the ſha- *Declaratio.*

dow of a *man* or any *Altitude*, ſhall be equall unto his height *double, triple, quadruple Quintuple* &c.

Conſtruction, 17. *Lay* the *Index* unto the numbers in the line of *ſhadowes* viz. to 1.2.3.4.5.&c. and whereſoever any of theſe diviſions in the line of *ſhadowes* meete with the *Index* amongſt the degrees; there it ſheweth what height the *Sun* muſt have, to make the *ſhadowes equall, double, triple* &c. to the *Exam.* *Altitude* So laying the *Index* upon 1 in the line of *ſhadowes*, it meeteth with 45. gr. in the *Index*: & ſo high the *Sun* muſt be to make the *ſhadow of a man* or any thing equall to his height upon an *Horizontall plaine*: then move the *Index* to and fro, untill the ſaid 45. gr. in the *Index* meete with the parallel of the day *Month*, viz the 20. of *April*, ſo the *houre line* that meeteth therewith, is the *houre* of the day that the *ſhadow* of a *Man*: or other *Altitudes*, will be *equall* to his heigth or *Altitude*, viz neere 10. of the Clocke in the *forenoone*, or 2. of the Clocke, in the *afternoone*.

And according to the ſame directions when ſhadows are	The *Altitude* would be.	and the *houre* the ſaid 20. of *April* would be,	*fore-noone.*	*after-noone.*
	gr. m.		ho. m.	ho. m.
Double.	26.33		7. 37	4. 23
Triple.	18.26		6. 43	5. 17
Quadruple.	14. 2		6. 16	5. 44
Quintuple.	11.19		5. 58	6. 02
Sextuple.	9. 27		5. 46	6. 14
Septuple.	8. 7		5. 37	6. 23
Octuple.	7. 7		5. 31	6. 29
Nonocuple.	6. 20		5. 25	6. 35
Decuple.	5. 43		5. 21	6. 39
Vigecuple.	2. 51		5. 2	6. 58

Secondly,

Secondly, to finde what proportion ſhadowes have to their bodies at any houre in the day, Azimuth, or Altitude of the Sun aſigned.

Pro. 15.

If the *houre* be knowne, or ſuppoſed, move the *Index* until it meete with the houre in the parallel of the day of the *Month*, ſo the interſection of that parallel with the *Index* is the *ſuns Altitude*, and the edge of the *Index*, in the *Limbe*, wil ſhew the *Suns Azimuth*, then move the *Index* until the degree of *Altitude* interſect the *line of ſhadowes*, ſo ſhall you have the proportion of *ſhadowes*, to their bodies required. *Conſtructio.* 18.

So if on the 11th. of *Aprill* at, 7. of the *Clocke* in the *forenoone*, (if the *Sun* ſhine,) it were required what proportion the *ſhadow* of a *man* ſhall beare to his height, or the *ſhadow* of an *Altitude* to the *Altitude*, the parallel that belongeth to the given day is neere 12. gr. *Marke* where this parallel meeteth with the given *houre* of 7. and bring the *Index* to it; ſo have you the *Suns height* at that *houre* viz 18. gr. 26. m, and the edge of the *Index* in the *Limbe* of the *Inſtrument*, ſhall give the *Azimuth* viz 4. gr. from the *Eaſt*: then move the *Index*, untill the degree of the *Suns Altitude* viz. *Exam.*

viz 18.gr.26.m, meete with the line of *ſhadowes* which will be in 3, which ſheweth that at 7. of the Clock in the *forenoone* the ſaid 11th. of *Aprill*, the *ſhadow* of a *man*, or the *ſhadow* of an *Altitude*, ſhall be *Triple* to his *height*: the like will be at 5. of the *Clocke* in the *afternoone*, for equall diſtances of the *Sun* from the *Meridian* the ſame day, without ſenſible error, will give equall *Altitudes* of the *ſun*, and equall *Altitude* of the *ſun* doth produce equall *ſhadowes* upon *Horizontall Plaines*.

Conſtructio. 19. *Secondly*, if the *Poſition* or *Azimuth* of the *Sun* be knowne or ſuppoſed, which admit 4 gr. from the *Eaſt* towards the *South*.

Lay the *Index* unto it in the *limbe*, & marke what degree in the *Index* the parallel meeteth with, which is with 18.gr.26.m, ſo have you the *ſuns Altitude* in the *Index*: then move the *Index* until ỳ degree meete with the *Line* of *ſhadowes*; ſo have you the proportion of *ſhadowes* required at that inſtant, viz *Triple* as before.

Conſtructio. 20. *Thirdly*, if the *Suns* height be knowne or ſuppoſed, which admit 18.gr.26.m, account it in the *Index*, and moove the *Index* until that degree meete with the *line of ſhadowes*; ſo where it interſecteth the *line of the ſhadowes*, there you have the proportion of *ſhadowes* to their *bodies* at that inſtant of time required, which will be *triple* as before; ſo the 10th. of *Aprill* if the *houre* be 7. or the *Altitude* 18.g.26.m, or the *Azimuth* 4.gr. from the *Eaſt* toward the *South*, the proportion of *ſhadowes* to their bodies will be *Triple*.

Thirdly,

Thirdly to finde the houre of the day agreeable to any Altitude or Azimuth, for any day of the yeare Proposed.

Pro. 16.

For the first account the *Suns Altitude* in the *Index*, and move it to and fro untill that degree meete with the parallel of the day of the *Month*: so the *Meridian* that passeth by that point, shal be the houre required.

Construct. 21.

Thus if the day were the tenth of *March*, the *Sun* being that day in the *Æquinoctial*, & the *Altitude* supposed to be 32. gr. 37. m, this I seeke out upon the *Index* and move the *Index* till that degree meete with the *Æquator*; so the *Meridian* or *houre Circle* that passeth thereby is the *houre* viz. 10. of the *Clocke* in the *forenoone* or 2. of the *Clocke* in the *afternoone*, and if you move the *Index* softly along as the degrees of the *Suns Altitude* in the *Index* intersect the *Æquator* (and so of any parallel:) so the *Meridian* that meeteth therewith is the *houre* of the day agreeable to that *Altitude*.

Exam.

For the second, to finde the houre of the day agreeable to any Azimuth.

Constructio. 22.

As suppose it were 36. gr. 35. m, from the *south*.

Exam.

South. Move the *Index* in the *Limbe* unto this *Azimuth* known or ſuppoſed; ſo where the *Index* croſſeth the parallel for the day given, there the *Meridian* that meeteth therewith, ſhewes the *houre* of the *day* viz 10. of the *Clocke* in the *fore-noone* or 2 in the *afternoone* as before. And if you move the *Index* ſoftly along, as the *Index* paſſeth by any *Azimuth* in the *Limbe*: ſo the edge of the *Index* ſhall interſect the parallel of *declination* for the day of the *Month*, in the *houre* of the day agreeable to that *Azimuth*: by which *propoſition* and the laſt, *Glaſſes* may be eaſily placed to burne according to the *Suns Azimuth*, or *houre aſſigned*.

Pro. 17. ***Fourthly, to finde the ſuns depreſſion, & poſition under the Horizon, at any houre of the night, with the houre of the day to our Antipodes, by ſuppoſing the ſun any number of degrees under the Horizon.***

Conſtruction. 23. *By* the 11th Conſtruction it is ſaid that any degree of the *Eclipticke*, is aſmuch belowe the *Horizon* at any time, as his oppoſite degree is above the *Horizon* at the ſame time: therefore if the *Index* be layed to the like parallel, on the contrary ſide of the *Æquator*, that meeteth with the given houre

houre the interſection in the *Index* ſhall ſhew you the degree of the *Suns depreſſion* under the *Horizon* at that *houre*.

So if at 10. of the *Clocke* at night the ſaid 13th of *October* it were required to finde the *Suns* depreſſion under the *Horizon*, conſider the *declination*, or the *ſuns* parallel for that day, which is 11. gr. and a halfe *South*, which *declination* I ſeeke in the other ſide of the *Æquator*, and marke where it meeteth with the *houre* of 10. unto which I lay the *Index*, ſo the edge thereof in the *Limbe* ſheweth the *ſuns Azimuth* to be neere 42 gr. 30. m. from the *South*, and the parallels interſection that meeteth with the *Index*, gives the *Suns* depreſſion, viz. neere 43. gr. and ſo much is the *Sun* below the *Horizon*, and in that poſition the 13th of *October* at 10. of the *Clocke* at night. *Exam.*

But if it were required at what *houre* of the *Night* the *Sun* would touch the verticall Circle of *Eaſt* and *Weſt* under the *Horizon*.

Lay the *Index* to the point of *Eaſt* and marke where about the Contrary pallet meeteth with the *Index*, for there you have both the *houre* and the degree of the *ſuns depreſſion*. *Conſtructio*, 24.

So the day being as before the 13th of *October*, & the *declination ſouth* 11. gr. and a halfe, this account amongſt the *North declinations* & it meeteth with the *Index* in 38 m. paſt 6. the *houre* of the Suns being *Weſt*, and with all the *ſuns depreſſion*, at the ſame time is neere 14. gr. and 50. m. *Exam.*

Pro. 18. *Fiftly, to finde the houre of the day to our Antipodes, by supposing the suns depression under the Horizon.*

Construction. 25. *Consider* the *declination* for the day, and move the *Index* to and fro untill the degree of the *suns depression* in the *Index*, meeteth with the like parallel or the other side of the *Æquator*, so the *houre* that meeteth therwith is the *houre* of the day to our *Antipodes*.

Exam. So if on the 20th. of *April*, we should suppose the *sun* to be 13. gr. under the *Horizon*, & desire to know the *houre* to our *Antipodes*, the parallel of *declention* for that day is 15. gr. *North*, Now in the *Index* account 13. degrees and move it to and fro untill the said thirteenth degree in the *Index* meete with the 15th. parallel of *South declination*, so the *Meridian* that meeteth therewith is the *houre* of the day to our *Antipodes*, within 2 m. of 9. at night.

Pro. 19. *Sixtly, to finde at what houre in any day, the suns Azimuth and Altitude will be equall, and how much the Altitude and Azimuth will be.*

Construction. *Move* the *Index*, to & fro untill the edge of the *Index*

Index meete with the parallel belonging to that day, in the ſame Number of degrees that the end of the *Index* in the *Limbe* from the point of *Eaſt* doth; ſo have you the degree of the *Suns Azimuth*, and *Altitude* equall the one to the other, and the *Meridian* meeting with the *Index* in the parallel of the given day, ſheweth at what *houre* that *Azimuth*, and *Altitude* will be equall.

So admit the *ſun* to be in the *Tropicke* of ♋, the *Index* being moued to and fro untill there be like degrees in the *Index*, and in the *Limbe*, which will be neere 16. gr. 45. m, and there the *houre* that meeteth therewith is 12. m, after 6. in the *forenoon*, at which *houre* the eleuenth of *Iune*, the *Suns Azimuth*, and *Altitude*, will be *equall* viz. neere 16. gr. 45. m, as before. *Exam*

Seuenthly, to finde what number of dayes any time of the yeare, will make the day an houre longer or ſhorter. *Pro.* 20.

Account 7. gr. and a halfe amongſt the *Meridians* from the given day in the *Kallender*, and note the day of the *Month* againſt it, then number the dayes betweene that day and the given day, and you haue the anſwer. *Conſtructio.* 27.

So if the day were the laſt of *February*, or the firſt of *March*, conſider the *Suns ſetting* that day by the Inſtrument, which is 40. m, paſt 5. this *doubled* *Exam.*

makes the length of the day, 11. *houres* 20.m, then from the last of *February* account 7.gr. and a halfe and it will point out the fifteenth of *March* at which time the Sun seteth at 10.m, past 6. which *doubled* makes 12 *houres* 20.m, so the fifteenth of *March*, the length of the day is an *houre* longer then it was the first of *March*; and the difference of time only but 15. dayes, but if the number of daies were accounted to or from the *Suns* entring into the *Tropicall points*, it will be more then 35. dayes before the day will be an *houre* longer or shorter.

Exam. *So* if from the tenth of *Iune* we should account 7.gr. and a halfe amongst the *Meridians* from that *Meridian* that meeteth with the tenth of *Iune*, it would fall out at the 16th. day of *Iuly*, at which time the day will be an *houre* shorter then it was the tenth of *Iune*, and the intervall of *time* more then twise as much as the former viz. 39. dayes.

Pro. 21

Eightly, to finde the inequalitie of time, in equall Mounthes or equall number of dayes.

This proposition at the first seemes as a *Paradox*, yet by this *Instrument* may easily be resolued, and so consequently from *Mathematicall* principles demonstrated, not onely the inequalitie of equall *Months*, but also the inequalitie of *Naturall dayes*.

Now

Now a day naturall according to the generall definition is one revolution of the *Æquator* or *primum mobile*, that is from *sun rising* to *sun rising*: or it is the time wherein the *sun* passeth by the *Meridian*, and commeth to the *Meridian* againe, commonly taken for 24. *houres*: but because that in that interyale of *time* the sun passing from the *Meridian* and commeth to the *Meridian* againe, the *Sun* moves according to his *Naturall motion* (*secundum antiquiorum traditionem*) neere a degree more or lesse; therefore the *Naturall day* shall be some what longer or shorter then 24. *houres*, viz. by so much as the difference of *right ascention* of that degree of the *Eclipticke* comes to that the *sun* is in, and seeing the degrees of the *Eclipticke* amongst themselues have not the same *difference* of *right Ascention* that the other degrees have, (notwithstanding the degrees of the *Eclipticke* amongst themselves being equall the one to the other) the *suns motion* ender those degrees being sometimes quicker, and sometimes slower, it will necessarily follow that the *sun* will move more or lesse untill the *sun* can touch the *Meridian*, which is the limit or tearme of the *suns diurnall revolution* as before: this difference and inequalitie of time in *naturall dayes* may by calculation be given from day to day, but because it is so insensible little in a day, hardly by an *Instrument* of this nature can be seene, but by a number of dayes, compared with another number of dayes it will evidently appeare.

So, if it were required how much the *Month* *Exam.*

of December is longer then the Month of *March*, in the first of which months the *suns motion* is quicker, being about the *Perigeum* then at other times, now both of which *months* have equal number of dayes, viz. 31.

Constructio. 28.

Finde the right ascention for the { beginning and ending } of *Mar.* viz. { 350.0. 19.30. } the difer. of right ascention for the Month of *May*. is 29.30.

Finde the right ascention for the { beginning and ending } of *Dece.* viz. { 257.¾ 292.¼ } the difer. of right ascention for the Month of *Dece*. is 34.30.

} the difference betweene these is 5.gr.

which 5.gr. being converted into time by allowing 4 minits to a degree makes about 20. m, and so much is the *Month* of *December* longer then the *Month* of *March*, notwithstanding both of these *Months* containing equall number of dayes.

Pro. 22. *Ninthly, to finde the degree of the Æquator in the Horizon, by supposing the degree of the Eclipticke in the Horizon.*

Notatio. If the degree given be inthe *Northerne* part of the *Ecliptike*, the oblique *Ascention* is lesse then the right *Ascention* vel contra. Get therefore first the right *Ascention* of the point given by the sixt Pro. and the difference of *Ascention* by the 2. Pro. for

Construction. 29.

that

that taken from the right *Ascention* gives the degree of the *Æquinoctiall* in the *Horizon*, but if the given degree had beene in a *Southren* signe, the difference of *Ascention* must be added to the right *Ascention*, so have you the degree of the *Æquator* in the *Horizon*.

Tenthly, to finde the degree of the Eclipticke in the Horizon by supposing the degree of the Æquator in the Horizon. Pro. 23.

This is but the Conuerse of the former, onely consider the correspondent quarters of the *Æquinoctiall* to these of the *Eclipticke*. *Construction.* 30.

Eleventhly, to finde the degree of Medium Cœli, or the degree of the Eclipticke in the Meridian, by supposing any degree of the Eclipticke in the Horizon. Pro. 24.

Seeke the degree of the *Æquator* in the *Horizon*, *Construction.* 31.

rizon, by the 22. Pro. ſubtract, 90. from it (if the Number be too little adde a whole *Circle* to it) then the degree of the *Eclipticke* oppoſite to the remainder, is the Anſwer, but note that if the remainder be betweene 270. and 360. the oppoſite point belongs to the laſt *Quarter* of the *Eclipticke*, if the remainder be betweene 180. and 270. then it reſpects the 3 quarter of the *Eclipticke*, if the remainder be betweene 90. and 180. it hath reference to the ſecond Quarter. &c.

But if the degree of the Eclipticke in the Horizon were required by knowing the degree of the in Eclipticke the Meridian.

Conſtruction. 23.

This, is onely but the converſe of the former, & is thus performed firſt, ſeek the right *Aſcentiõ* of the given degree of *Medium Cœli*, & adde thereto 90. gr. by accounting it from the former right *Aſcention*, & note the *ſigns* place oppoſit therto for the difference of *Aſcention* of this laſt degree being ſubtracted from the former *degree* of the *Æquator* in the *Horizon*, if it be a degree of the *Southren ſignes* (otherwiſe Adde) gives the degree of the *Eclipticke* in the *Horizon* demanded.

Twelfthly

Twelfthly, to finde the Horoſcope or the degree Aſcendant, or deſcendant and the Nonageſſima degree at any houre.

Pro. 25.

Firſt, note the *right Aſcention* for the day given according to the 6. Pro. which is the degree of the *Æquator* in the *Meridian*, at 12. of the *Clocke*, unto which degree adde 90. ſo have you the degree of the *Æquator* in the *Horizon* at 12. of the Clocke. Then conſider how many *houres* the given *houres* wants of 12. or is paſt 12. which conuerted into meaſure and accounted *Eaſtward*, or *Weſtward*, according to the *houre* given from the former points of the *Æquator* in the *Horizon* at 12. will give the degree of the *Æquator* in the *Horizon* at the *houre* propoſed, then by the 23. Pro. I ſeeke out the degree of the *Ecliptick* in the *Horizõ* anſwerable to the degree of the *Æquator* ſo have you the degree *Aſcendant*, from which accouut 90. gr. or 3 *ſignes*, ſo have you the degree of the *Nonageſſima point* in the *Horizon*, but if you reckon 6. ſignes from the *Aſcendant*, you have the *deſcendant* degree of the *Ecliptick* in the *Weſt* of the *Horizon*.

Conſtruction, 33.

Pro. 26. ## *Thirteenthly, to finde what Angle the Ecliptick makes with the Horizon, or the Altitude of the Nonagessima degree of the Ecliptick, above the Horizon, and what Azimuth it is in at any houre.*

Construct. 34. According to the last Pro. finde the degree *Ascendant*, and the *Nonagessima* degree, then by the 24. Pro. finde what degree of the *Ecliptick* is in the *Meridian*, Answerable to the degree of the *Ecliptick* in the *Horizon*, so shall you know on which side of the *Meridian* the *Nonagessima* degree is, & how far from the *Meridian*, then if ỳ *Index* be layed upon the *houre* of 12, where the parallel of the *Nonagessima* degree crosseth it, that should be the height of it, if it were in the *Meridian*; account therfore from the *Meridian* or houre of 12. in the *Æquator*, the number of degrees betweene the *Nonagessima* degree, and the degree of the *Ecliptick* in the *Meridian*, & marke where that *Meridian* meeteth with the parallel of the of the *Nonagessima* degree, lay the *Index* thereto,

so

ſo have you the *Altitude* of the *Nonagesſima* degree in the *Index*, and the *Azimuth* in the *Horizon*, or *Limbe* of the *Inſtrument*.

There are yet the 48. 49. 50. 9. 13. 14. and 15th. uſes of the ſaid *Index* or *Table*, which haue no relation to the *ſuns* ſight or obſervation in there operation, and reſolutions, and ſhould have followed theſe 26. uſes that have beene delivered: but I referre them to the end of this *Tractat*; as for theſe uſes of the *Inſtrument* which depend upon the *Suns* ſight, or obſervation they are theſe 13. following viz. the 1. 31. 4. 6. 36. 7. 22. 3. 5. 34. 11. 43. and 8th.

viz. to shew

1. The Sun, or starres Altitude above the Horizon at any time.
2. The houre of the day, and Azimuth of the sun.
3. The Meridian Line upon any appearance of the Sun.
4. The sit of a building, or casting of a place.
5. The Suns Azimuth, and houre without Observation.
6. The variation of the Needle.
7. The Latitude of a place, or height of the Pole above the Horizon.
8. The Suns Azimuth, and Altitude at any houre.
9. The vncertainetie of time, by noting the shadow of things.
10. The Quarter of the yeare and day of the Month, with the houre, Azimuth, and the Meridian line.
11. Instantly the houre of the day, the Azimuth, and Altitude of the Sun: with the Meridionall line, without observation or sight of the Sun, by knowing the Proportion betweene the length of a shadow upon a Horizontal Plaine, and that which did cast the shadow.
12. The Declination of a Wall, by seeing the Sun beginning to shine thereon or going from it.
13. The Declination of a Wall, the Sun shining thereon.

First

Firſt, how to obſerue the Sun, or ſtarres Altitude above the Horizon at any time. Pro. 27.

Liſt up the edge of the *Inſtrument* to the eye, ſo that the ſight which is at the *Limbe* or *Circumference* of the *Quadrant* be next the eye, and the *Index* to hang perpendicular and to play eaſily by the ſide therof: then move the *Quadrant* up and downe untill you may through both ſights ſee the *Center* or midle of the *Sun*, or *ſtarre*: ſo the *Index* in the *Limbe* ſhall fall upon the degrees of the *Sun* or *ſtarres Altitude* above the *Horizon* at that time. Or without looking at the *ſun*, the *Altitude* thereof may be thus found: hould the *Quadrant* that the *Index* may hang perpẽdicular, or be *verticall* as before, then move about the *Inſtrument* untill the edge of it be oppoſite to the body of the *Sun*. Now ſuppoſing the *Inſtrument* to hang thus upon his *Center*, ſoftly lift up the edge thereof which is towards the *Sun*, untill you ſee the beames of the *ſun* paſſe through both *ſights*, then the *Index* in the *Limbe* ſhall give the *ſuns Altitude* as before. *Conſtruction.* 35. *Conſtruction.* 36.

Secondly,

Pro. 28. *Secondly, how to finde the houre of the day, and Azimuth of the Sun, upon any appearance of the Sunne.*

Construction. By the last *Pro.* obserue or take the *Suns Altitude* and account it on the *Index*, then seeke for the parallel of the day of the *Month* for the day present, & move the *Index* untill that degree of *Altitude* in the edge of the *Index* meete with the parallel of the day, so the *Meridian* that meeteth with that degree of *Altitude* in the *Index*, shall be the houre of the day required, & the edge of § *Index* in the *Limbe* of the *Instrument*, shall likewise shew the Suns *Azimuth* belonging to that houre.

Exam. So if upon the last of *August* the *Suns Altitude* in the forenoone should be obserued and found to be 30.gr. & a halfe, seeke this *Altitude* out upon the *Index* & move the *Index* untill the degree of *Altitude* meete with the parallel for the day of the *Month* given, viz. the fift parallel from the *Æquator Northward* so the *houreline* that meeteth also with the 30.gr. & a halfe in the *Index*, is the *houre* viz. neere 9. & that shall be the *houre* of the day at that instant, & the edge of the *Index* in the *Limbe* cutteth neere 35.gr. and 30.m, from the point of *East*, towards the South, and so much is the *Suns Azimuth* at that time.

Thirdly,

Thirdly, how to finde the Meridian line, and the true points of North, & South, East, and West upon any appearance of the Sunne. Pro. 29.

According to the 27. *Pro.* first obserue the *Suns Altitude* above the *Horizon*, and by the last Construction finde the *Suns Azimuth* agreeable to that *Altitude*: let the *Index* and rest, at that degree, and erect the prependicular at the end of the *Index*, then houlding the plaine or *face* of the *Quadrant* parallel to the *Horizon*, move the *Instrument Circular*, untill the shadow of the said perpendicular fall by the side of the *Index*, and so the *houer line* of 12, or the edge of the *Instrument* which is parallel unto it (which is the *North* and *south* edge of the *Instrument*) shall represent the *Meridian line*, and pointeth out the *North* and *South* in the *Horizon* of the world by the termes thereof, and the other straight edge of the *Instrument* which is perpendicular unto that edge is the (*East* and *West* edge of the *Instrument*) and denoteth or sheweth the line of *East*, and *West* in the *Horizon*, of the world. But this may be more accurately done if you place the backe *Construction.* 28.

of the *Inſtrument* downe upon an *Horizontall* plaine, and the edge of the *Index* being at the degree of the *ſuns Azimuth* obſerved, and the perpendicular erected at the end of the *Index* as before: then moving the *Inſtrument* as it ſo lyeth untill the ſhadow of the perpendicular fall by the ſide of the *Index*, ſo the *Meridian* of the *Inſtrument*, ſhall be in the *Meridian* of the World, and every point and degree in the *Limbe* of the *Inſtrument* ſhall point out, and be oppoſite, and repreſent his like degree in the *Horizon* of the world.

Conſtruction.39. But here note that this *Conſtruction* ſerves only but for the forenoone obſervation; for if the practice be in the afternone, the way to finde the *Meridian* line may be thus. Having found the *ſuns Azimuth* as before, lay the *Index* upon the houre line of 12. and erect the perpendicular at the end thereof, and move the *Inſtrument* about *Circular*, untill the ſhadow of the ſaid perpendicular fall by the ſide of the *Index*: for then if the edge of the *Index* be moved unto the *ſuns Azimuth* before known, the edge of the *Index* ſhall repreſent the *Meridian* line; & 90. gr. farther ſhall be the point of *Eaſt*, and the *Center* of the *Inſtrument* the point of *Weſt*, therefore if upon the plaine that the *Inſtrument lies* upon, you make a marke at the edge of the *Index* which is in the *Meridian* as before, and another marke right under the *Center*, and ſo place the *North* and *South* edge of the *Inſtrument* unto theſe two points: then every

every degree in the *Horizon*. or *Limbe* of the *Instrument*, shall point out as before his opposite or like degree in the *Horizon* of the world.

Fourthly, how to finde the sit of a Building, or Cosling of a place. Pro. 30.

By the last *Pro.* finde out or draw the *Meridian line*, and place the *North* and *South* edge of the *Instrument* unto it: if the *Building* or *Place* ly in the *Easterne semicircle* of the world (but if it ly in the *Westerne semecircle*, then let the *East* & *West* edge of the *Instrument* be placed upon the *Meridian* line) so the eye being over the *Center* of the *Instrument*, and beholding the place, let the *Index* be moved untill it be also with the visual line observed by the eye, that is opposite to the place, so the edge of the *Index*, from the *Cardinall* points of the *Instrument* in the *Limbe*, viz. from the *East* or *West*, *North* or *South*, shall shew the bearing of that place from you, in respect of the *Cardinall* points of the world in the *Horizon*: but if two sights be placed at the *Index* (which is according to the description thereof) then may you observe the place through the sights of the *Index* by leting the *Instrument* rest, and moving the *Index* to and fro untill you see the object, so the edge of the *Index* in the *limbe*, shall point out the *Constructio*, 40.

bearing or *Position* of the place from you in degrees from the *East*, *West*, *North*, or *South*, & accounting 11.gr. and ¼ as often as you can in those degrees, observed: you have the point of the *Compasse* which the place, or obiect beares from you.

Pro. 31.

Fiftly, to finde the Suns Azimuth, and houre without observation.

Construction. 41.

The *Meridian line* being drawne first upon a plaine according to the former directions, consider if it be in the forenoone or afternoone; if in the forenoone, then let the *North*, and *South* edge of the *Instrument* be placed unto the *Meridian line*, but if it be in the afternoone, then set the edge of *East*, & *West* of the *Instrument*, unto the *Meridian line*, and let the *Instrument* rest there, then erect the perpendicular at the end of the *Index*, & move the *Index* about untill the shadow of the perpendicular fall by the side of the *Index*, so the edge of the *Index* will amongst the degrees in the *Limbe* shew the *Suns Azimuth* at that time; and where the edge of the *Index* meeteth with the parallel of the day of the *Month*, that is the *houre* of the day at that time. *But* if the *Axis* be rectified, then there is no neede of a *Meridian line* to be drawne, for this *Instrument* will with great facilitie finde out his owne *Meridian*, by moving it to and fro untill the

the ſhadow of the perpendicular which is ouer the *Center* of the *Inſtrument*, interſect the ſame *houre* in the *Parallel* of the day of the *Moneth*, that the *Axis* doth amongſt the Common *houres*: ſo that *houre* ſhall be the *houre* of the day for that inſtant, and the ſhadow of the ſaid perpendicular, cutting the *Limbe*, or extended unto it, doth there ſhew the Suns *Azimuth*, and ſo the *Meridian* of the *Inſtrument* at that poſition, ſhal be in the *Meridian* of the world required.

Sixtly, to finde the variation of the needle.

Pro. 32.

By the twentie nineth *Pro.* vpon an even *Plaine* parallel to the *Horizon* draw the *Meridian line*, & place the *North* & *South* line of the *Card* directly over the ſaid *Meridian line*, ſo the Number of degrees that the *Needle* cutteth in the *Card* from the *North* and *South* line of the *Card*, that ſhall be the variation of the *Needle* required; otherwiſe it may be found thus: Neere unto the *Center* of the *Index*, upon the *Index* may a ſmall *Braſſe pinne* be ſo placed that it may be erected perpendicular to the *Center* of the *Inſtrument* and halfe an inch above it. Let a *Needle* by placed upon this pinne, then lay the *Eaſt*, and *Weſt* edge of the *Inſtrument* to the *Meridian line*, & when the *Needle* reſteth, move the *Index*, untill the edge of it be directly under the *Needle* ſo the edge of the *Index*; in the *Limbe* of the *Inſtrument*, ſhall

Conſtruct. 42.

point out or ſhew the *Needles variation* required.

Pro. 33. *Seventhly, to finde the Latitude of a place, or the Poles hight above the Horizon.*

Conſtruc. Fig. 43. *First*, draw the *Meridian line* upon ſome plaine by helpe of the 38. *Conſtruction*, then erect the prependicular at the end of the *Index*, and place the *North* and *South* edge of the *Inſtrument*, to the *Meridian line* ſo drawne upon the plaine, and move alſo the *Index* untill the edge thereof touch the houre of 12. let the *Inſtrument* reſt at this poſition, then marke diligently about noone or 12. of the Clocke when the ſhadow of the perpendi cular doth fall by the edge of the *Index*, for then the *ſun* is in the *Meridian*, at which time according to the 27. Pro. obſerue or take the *ſuns* height (which is his *Meridian Altitude*, for that day) and by the 3. *Pro.* finde the Suns *declination* agreeable to that day, and adde it to the *Suns Meridionall Altitude* obſerve (if it be *South declination*, otherwiſe ſubtract it from the former *Meridionall Altitude*,) ſo have you the height of the *Æquinoctial* above the *Horizon*, that taken from 90. gives the depreſſion of the South *Pole* under the *Horizon*, which is alwayes equall to the elevation of the *North Pole* above the *Horizon*.

So

So if upon the tenth of *April*, the *Meridian Altitude* should be found to be 50. gr. the *Declination* belonging to that day by the 3. Pro. is 11. gr. and a halfe *North*, which being subtracted (according to the former directions) leaves 38. gr. 30. m, the height of the *Æquinoctiall* above the *Horizon*: & that taken from 90. leaves 51. gr. 30. m the depression of the South *Pole* under the *Horizon*: or the elevation of the *North Pole* above the *Horizon*, for the height of the *Æquinoctiall* knowne, the Complement thereof is alwayes the *Latitude* of the place, or height of the *Pole*: and here note generally that the height of the *Pole* and *Æquinoctiall* together, doe alwayes make a *Quadrant* or 90. gr. therefore the height of one of them being knowne, the height of the other is also knowne, and further here note that if the *Sun* have *North Declination*, the *Sun* is so much higher then the *Æquinoctiall* at none that day, by so much as his *Declination* cometh to, but if the *Sun* have South *Declination*, then the *Sun* is lower then the *Æquinoctiall* that day at noone, by so much as his *Declination* cometh to, by which you may easily gether when to adde, or subtract the *Suns Declination to*, or from the *Suns Meridianall Altitude* to get the height of *Æquator*, which knowne the *Poles* height cannot be unknowne.

Exam.

Pro. 34 *Eightly, to finde the ſuns Azimuth and Altitude for any houre.*

Conſtruction.44. *Marke* where the parallel for the day of the *Month* meeteth with the given *houre*, and bring the edge of the *Index* thereto, ſo the degree that the edge of the *Index* cutteth in the *Limbe* of the *Inſtrument*, that ſhal be the *Suns Azimuth*, and the degree that the *houre* cutteth in the *Index*, that ſhall be the *Suns Altitude* required.

Exam. *So*, if upon the tenth of *December* at nine of the Clocke in the Morning, the *Suns Azimuth* and *Altitude* were required, marke firſt where the *Tropick* of *Capricorne* (which is the parallel for that day given) meeteth with the given *houre* of nine, and bring the *Index* thereto, ſo the edge of it in the *Limbe* pointeth out neere 40.gr. and a halfe, & ſo much is the *Suns Azimuth*, from the *South*, at nine of the *Clocke* in the forenoone, the ſaid tenth of *December*, and the *houre line* meeting with the *Index*, ſheweth neere 5.gr.25.m. ſo much is the *ſuns Altitude* at that time; now if you move the *Index* ſoftly along, as the edge of it paſſeth by any *houre* for any day of the yeare, ſo the edge of the *Index* in the *Limbe* of the *Inſtrument* ſheweth the *ſuns Azimuth*, and the interſection of the parallel with the *Index* ſhall ſhew the *Suns Altitude* belonging to that *houre*.

Ninthly,

Ninthly, to ſhew the uncertaintie of time, by noting the ſhadow of things.

Pro. 35.

It is uſually noted by ſome, that when the ſhadow of the edge of a Window, Dore, Wall, or ſuch like, ſhall touch ſuch or ſuch markes, that it ſhall be then ſuch, or ſuch an houre of the day, and ſo conſtantly to hould for all the yeare, this obſeruation is farre from truth, and the principalls of *Aſtronomie* (and may be eaſily contradicted by ſuch which have but indifferent judgement in the Nature of ſhadowes, and the *Suns* paſſages by the *Meridians* and verticall *Circles* of the Heavens, for by how much greater the propinquitie of the *Suns* approchment is unto the *Zenith*, or verticall point, by ſo much the more ſhall the houre or time be various in one and the ſame *Azimuth*.

So in the laſt *Pro.* the *Azimuth* of the *Sun* the tenth of *December*, at nine of the *Clocke* in the forenoone, was found to be 40. gr. and a halfe, and *Exam* the *Suns* diſtance from the *Zenith*, at that time was neere 84. gr. 35. m, Now admitte the *Suns* diſtance from the *Zenith* the tenth of *Iune* were but 32. gr. 35. m, the Sunne being in the ſame *Azimuth*, the houre would be halfe an houre paſt 10. For the *Index* being layed to the *houre* of 9. in the *Tropicke* of ♑. (which is the *Suns* parallel, for the ſaid tenth of *December*,) and it cutteth the parallel

Construction.45. parallels of the *Suns Motion* in the inequalitie of time, and so the complement of the former 32.gr 35.m, in the *Index*, meeteth with the *Tropicke* of ♋, (which is the *Suns* parallel for the tenth of *Iune*) in halfe an houre past 10. so that it evidently appeares, that the shadow of a perpendicular thing on the tenth of *December*, denoting the *houre* of the day to be 9. of the *Clocke*, the same shadow the tenth of *Iune*, shall represent halfe an houre past 10. so the error shall be an houre and a halfe: but if you move the *Index* unto the houre of 9. belonging to the tenth of *Iune*, the *Index* shall point you out in the *Limbe* neere 68.gr. of *Azimuth* for that *houre*, which at 9 of the Clocke the tenth of *December*, was but 40.gr. & an halfe, so the difference of *Azimuth* in one and the same *houre*, shall be 27.gr. and a halfe, & the time as before, an houre and a halfe: which differences are sufficient to confirme the point.

Tenthly, to finde the Quarter of the yeare, and day of the month, if it were forgotten.

Pro. 36.

Construction.46. *At* any appearance of the *Sun* by the 27. *Pro.* take the *Suns Altitude*, then place the *North* and *South* edge of the *Instrument* unto the *Meridian line* formerly drawne (if in the forenoone) otherwise place the *East*, and *West*, edge of *Instrument* to the *Meridian-*

line

Iune, and erect the prependicular at the end of the *Index*, then moove the *Index* to and fro untill the *ſhadow* of the prependicular fall by the ſide of the *Index*, ſo the parallel that meeteth with the degree of the *Suns* obſerued *Altitude*, in the edge of the *Index*, parallel in the *Kalender* that ſhall ſhew the day of the *Month* required.

So if, upon a certaine day in the yeare the *ſuns Altitude* were obſerved and found to be 36.gr. having placed the edge of the *Inſtrument* to the *Meridian* line, and rectified the *Index*, then move the *Index*, untill the ſhadow of the prependicular fall by the edge of the *Inſtrument*, let the *Inſtrument* reſt at this poſition, and account the former 36.gr. upon the *Index*, which degree meeteth with the houre in the *Æquator*, and alſo that interſecteth the *Kalender*, in the tenth of *March*, & the thirteenth of *September*, but which of theſe dayes is the day of the *Month*, the next dayes obſeruation of the *Sun* upon the ſame houre will helpe you, for if the *ſuns Altitude* be found to be greater then the day of the month inquired after it was the tenth of (*March*, becauſe the *ſun* from the tenth of *December* unto the eleventh of *Iune*, doth every day at one & the ſame houre, aſcend,) but if the *Suns Altitude* be found to be leſſe then the former dayes obſervation ſpecified was, then the day required, was the thirteenth of *September*, becauſe that from the eleventh of *Iune*, unto the tenth of *December*, the ſuns *Altitude* every day doth ſenſibly diminiſh at one and the ſame houre.

Exam.

☞ *But* here is to be noted that if there be no *Meridionall line*, then the prependicular over the Center and the *Axis* of the *Index* being erected, place downe the backe of the *Inſtrument* upon an *Horizontall* plaine, and move the *Inſtrument* to and fro, untill the ſhadow of the *Axis* meete with the ſame houre below the *Tropicke*, amongſt the common houres, that the ſhadow of the prependicular over the Center of the *Inſtrument* meeteth with on the face of the *Inſtrument*, for then the parallel that croſſeth or meeteth with the *ſhadow* of the prependicular, and the *houre*, will in the *Kalender* ſhew the day of the *Month* required, and ſo then the *Meridian* of the *Inſtrument* ſhall be in the *Meridian* of the world, and every point or degree in the *Horizon* of the *Inſtrument*, it ſhall point out his like, or oppoſite degree in the *Horizon* of the world.

Conſtructio.47.

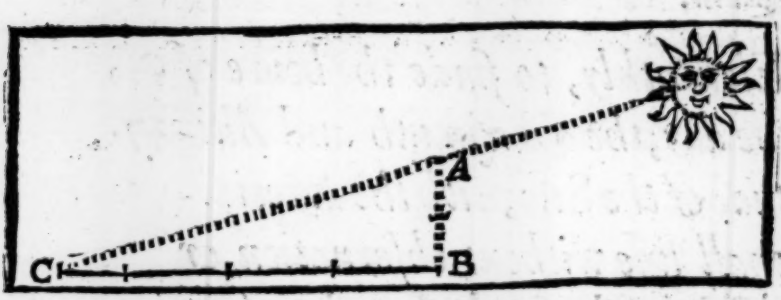
Conſtructio,48. Or otherwiſe it may be done thus, take the Suns *Altitude*, then immediatly by ſome Watch, clock, or Sun-dyall, learne the *houre* of the day, and move the *Index* to and fro, untill the *Suns Altitude* in the *Index*, meete with the former houre, ſo the parallel that meeteth therewith, ſhall ſhew the day of the *Month* in the *Kalender* required, then having the day of the *Month*, you have the *Quarter of the yeare*, for from the tenth of *March* unto the eleventh of *Iune*, is the *Spring quarter*, from the eleventh of *Iune*, to the thirteenth of *September*, is the *Summer quarter*, from the thirteenth of *September*, to the tenth of *December* is the *Autumnall*

nuall quarter, and from the tenth of *December*, unto the tenth of *March*, is the *Winter Quarter*.

Eleuenthly, to finde the houre of the day, the Azimuth and Altitude of the Sun, with the Meridionall line without obseruation, or sight of the sun, by knowing the proportion betweene the length of a shadow upon a Horizontal Plaine, and that which cast the shadow. Pro. 37.

First, let the thing that casteth the *shadow*, or something equall in length unto it, be divided into ten equall parts, and each of those parts subdived into ten other equall parts, (which thing so divided shal represent a common *scale*,) then measure the shadow with the *scale*, and marke how often the *shadow* is longer then the *scale*, and the *Decimall* part if there be any, so have you the proportion betweene the *shadow*, and that which *Constru Eleu.* 59.

did caſt the *ſhadow*, and then is it reſolved accor-
to the conuerſe of the fifteenth Pro.,



Exam. Admit ſome one: upon the 12. of *February*, or on the ninth of *October*, houlding *a ſtaffe* prepen-dicular as *A B*, or ſuppoſing it to be part of the Coyne of a *Houſe*, or edge of a *Window* or ſuch like ſhould caſt a *ſhadow*, as *B, C*, which being noted, or drawne and having divided the *ſtaffe*, or thing as before, and ſhould then meaſure the *ſha-dow*, as *B, C*, by the ſaid *ſtaffe* or *ſcale*, and finde it to be contained therein three times, and 6, parts or 6, decimals, the porportion of the *Gnomon*, or *ſcale, A B*, to the *ſhadow B C*, would be as 1 to 3. and $\frac{6}{10}$.

Conſtructio. Move therefore the *Index* to and fro, untill the edge of it meete with 3. and $\frac{6}{10}$, in the line of *ſhadowes*; ſo have you the degree of the *Suns Alti-tude* at that inſtant in the *Index*, viz. 15. gr. and $\frac{1}{2}$ then ſeeke out the parallel for the 12. of *Fe-bruary*, or the ninth of *October* (the day given) which is neere the tenth degree from the *Æqua-tor South*, move the *Index*, untill the former 15. gr. and

and ½ in the *Index*, meeteth with the ſaid parallel for the day, ſo have you the *houre* belonging to that time, which will be neere 42 m, paſt 8. in the Morning, or 18. m, paſt 3 in the after noone, and the edge of the *Index* in the *Limbe* of the *Inſtrument* ſheweth the *ſuns Azimuth* alſo at that inſtant, viz, neere 39. gr. 12. m, from the *Eaſt* toward the *South*.

Now for the Meridionall line, this may be done at any time after, if the *Azimuth* be not forgotten: for if the Center of the *Inſtrument* be layed downe upon any part of the *ſhadow B C*, and ſo the *Inſtrument* to be mooved upon his Center untill the ſaid *ſhadow B C*, formerly drawne, cut the edge of the *Limbe*, in the aforeſaid *Azimuth* of 39. gr. 30. m, then the *Meridian* of the *Inſtrument* ſhall be in the *Meridian* of the world, and if that *ſhadow* were from a *Window*, or *Building*, the poſition of the *Inſtrument*, ſhall denote the *poſition* of the *Window* or *Building*. *Conſtruction.* 51.

Twelfthly, to finde the Declination of a Wall, by ſeeing the ſun beginning to ſhine thereon, or going from it. *Pro.* 38

By the 27. *Pro.* take the height of the *Sun*, and by the 28. *Pro.* finde the *Suns Azimuth* for the *Altitude*, *Conſtruction.* 52.

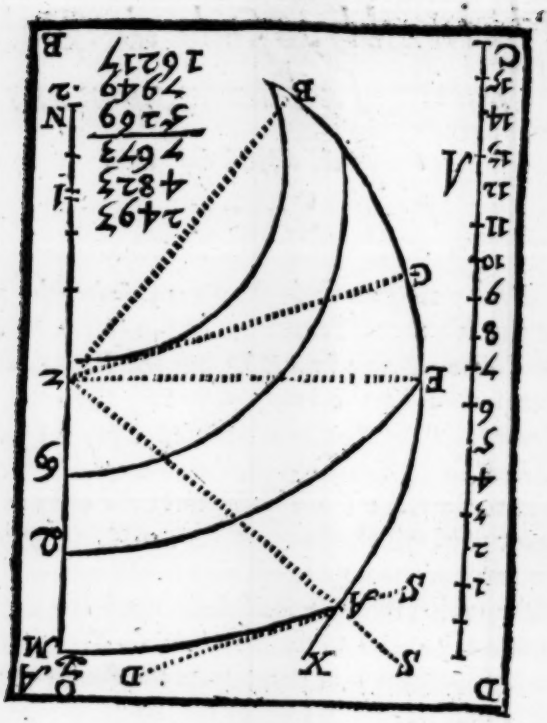
Altitude, ſo the *Azimuth* thus found ſhall be the declination of the *Plaine* required: for the declination of any perpendicular *Plaine*, is accounted from the points of *Eaſt*, *Weſt*, *North* or *South*, in the *Horizon*, as the *Suns Azimuth* is: therefore whatſoever *Plaine* is in the plaine of any *verticall Circle*, that Plaine is as far from any of the Cardinal points of the *Horizon*, as the *ſun* is at that time, & ſo the *Sun*, being in that *verticall Circle*, ſhall neceſſarily glance upon the *Plaine*: and therefore looke what the *Suns Azimuth* is at that inſtant, ſuch ſhall be the *Declination* of the *Plaine* required.

Thirteenthly, to finde the Declination of a Plaine, upon any appearance of the Sunne.

Pro. 39.

By the 28. *Pro.* finde the *Suns Azimuth*, and set the *North* and *South* edge of the *Instrument* to the *Plaine*, which admit $Z \Upsilon$, but the *Plaine* to be represented by the line, $\mathcal{M}\mathcal{N}$, then let the *Azimuth* of the *Sun* be accounted from the point of *East*, in the *Limbe* of the *Instrument*, viz according to the Arke $E\mathcal{A}$, and moove the edge of the *Index* to it, which admit to be $\mathcal{A}Z$, then erect the perpendicular plate which is at the end of the *Index*, which suppose AX, now houlding the *Instrument*, parallel, to the *Horizon*, let S, represent the *sun*, which if at that instant the *shadow* of the perpendicular, or beame of the *sun* shall passe by the side of the *Index* AZ, then the plaine $\mathcal{M}N$, is full *South*, and hath no *declination*, but if the beame of the *sun*, or *shadow* of the prependicular, fall, from the side of the *Index* the *Plaine* $\mathcal{M}N$, doth *decline*, and is equall to the Angle made with the said *shadow*, and the *Index* AZ, which suppose to be $\mathcal{A}D$, so the *Declination* of the *Plaine* MN, is equall to the Angle $D\mathcal{A}Z$, therefore moove the *Index* untill the *shadow* of the perpendicular of the *Index*, AX, fall by the side of the

Construction. 53



the *Index* which will be at *G*, ſo the number of degrees contained betweene *A*, and *G*, in the *Limbe* of the *Quadrant*, is the *declination* of the *plaine* or *Wall*, *M N*, required.

Thus for the Conſtruction of the aforeſaid 13. uſes which did depend upon the *ſuns obſervation*, the 48.49.50.9.13.14.and 15th.uſes of the *Index* or *Table* againſt Page the firſt, ſhould have followed; but before I ſpeake of them it will not be inconvenient

convenient that I apply the *Instrument* unto the resolution of the 44.45.46.& 47. uses of the aforesaid *Index* or *Table*, which have reference to night observation, upon such *Starres* which are, or may be placed on the face of the *Instrument*, betweene the two *Tropickes*, or under the *Tropicke of Cancer*, according to there *Declinations*, and *right Ascensions*: which are these following.

The names of the Starr	Decls. G. M.	Rec: H. M.	G.M.	The names of the starrs	Decls. G.M.	Rec. H.M	G. M.
Ex. Ala Pegasi	13.9. N.	23.54.	1. 30.	Cor Hydræ.	7.5. A	9.10.	42.45.
pri. ♈.	21.40.N.	1.46.	26.30.	Cor Leonis.	13.45.B.	9.48.	33.00.
Oculus. ♉.	15.42. N.	4.15.	63.45.	Cauda ♌.	16.38.B	11.30	7.26.
pri singuls. Ors:	0. 37. S.	5.13.	78.15.	Spica. ♍.	9.10.M.	13. 5.	16.15.
Canis maior.	16.12 S.	6.30.	82.15.	Arctnrus.	21.10.B.	14. 0.	29.30.
Canis minor.	6. 9. N.	7.20.	70.00.	Aquila.	8.00. S.	19.32	66.45.

Much may be said upon the uses of these *Starres*, but for brevitie I onely delivere these foure examples following.

1. *First*, for any night of the *yeare*, to find at what *houre*, and *Altitude* any of the said *Starres* will be in the *Meridian*, (that so they may be known.)

2. *To know* at any day, at what *houre* any of these *Starres* riseth, or setteth, with their time of continuance above the *Horizon*, and in what part of the *Hemisphere*, they may be seene with their *Azimuth*, and *Altitude* at any houre.

3. *Thirdly*, to finde in any night at what part of the *Horizon*, any of the aforesaid *starres* riseth, or setteth, and at what *houre*, and *Altitude* they will be due *East*, or *West*.

4. *Fourthly*, upon the sight or apparance of any of the said *Starres*, to finde the *Azimuth* thereof: and the *houre of the night*.

Pro. 40. *First in any night, to finde at what houre and Altitude, any of the aforesaid starres will be in the Meridian.*

Construction. By the sixth *Pro:* finde the *Suns* rigth *Ascention* for the day given, which conuerted into time by allowing for every 15. degrees an *houre*, and for every *degree* 4.m, then substract this *right Ascention* of the *Sun*, from the *starres right Ascention*, so the remainder or difference of time, shall shew how many *houres* the *starres* shall come later to the *Meridian* then the *Sun*: but if the substraction cannot be made, then adde 24. houres to it &

Exam. you have the *Answere*, so, if upon the sixth of *February*, it were required to find at what *houre* any of the aforesaid *starres* will be in the *Meridian*, or due *South*, first therefore by the said sixth *Pro.* I find the *suns rights Ascention* for the day given viz, 330. gr. which containes three nineties or 270.

270. each 90.gr. being ſix *houres*, and ſo the whole 270.gr.makes 18.*houres*, and the other 60. gr.at 15.gr. to an *houre* makes 4. *houres* more all which put together makes 22.*houres*: ſo the *right Aſcention* of the *Sun* the ſixth of *February*, is neere 330.gr.as before, or 22. *houres*

		H.M.		H.M.	
Which 22. houres taken from the right aſcention of the aforeſaid Stars, viz. from.	*Ex Ala Pegaſi.*	23.54.	there remaines.	1.54. P.	the time of the ſtarres being in the *Meridian.*
	Pri. ♈.	1. 46.		3.46. P.	
	Oculus. ♉.	4.15.		6. 15. P.	
	Orion ſinqu. I.	5. 13.		7. 13. P.	
	Canis Maior	6. 30.		8.30. P.	
	Canis Minor.	7. 20.		9. 20. P.	
	Cor Hidra.	9. 10.		11.10.P.	
	Cor Leonis.	9. 48.		11.48.P.	
	Cauda ♌.	11.40.		1. 40. A.	
	Spica virginis.	13.05.		2.05. A.	
	Arcturus	14.00.		4. 00. A.	
	Aquila.	19.32.		9. 31. A.	

For ſeeing that 22. *houres* the *Sunnes right Aſcention*, is greater then the *right Aſcention* of any of the *ſtarres* afore ſpecified, ſubſtract this 22,*houres* from 24. *houres*, reſt 2. *houres*, which added to the *right Aſcention* of each *Starre* before delivered, you have the *houre* of the *Stars* coming to the *Meridian*: hence you may gather which of thoſe *ſtarres*, are out of obſervation for that time, viz. *Ala Pegaſi*, *Pri.♈*, and *Aquila*, which come to the *Meridian* in the day time: but if the day given had been the 26th of *Iuly*, the *right Aſcention* of the *Sunne*, that day is neere 135. gr. or 9.*houres*.

which 9. houres taken from the right Ascention of the aforesaid starrs viz, from.	H.M.	leaves	H.M.	the time of the starrs coming to the *Meridian*.
Ex. Alæ Pegasi.	23.54		2.54. A.	
Pri. ♈.	1.46.		04.46.A.	
Oculus ♉.	4. 15.		07.15.A.	
Orion Singu.	1.5.31.		08.13.A.	
Canis Maior.	6.30.		09.30.A.	
Canis Minor.	7.20.		10.20.A.	
Cor hidræ.	9. 10.		00.10.P.	
Cor Leonis.	9.48.		00.48.P.	
Cauda. ♌.	11. 40.		02.40.P.	
Spica virginis.	13.5.		04.05.P.	
Arcturus.	1400.		05.00 P.	
Aquila.	19.32.		10.32.P	

For the right Ascention of the *Sun* being but 9. *houres* take it from the *right ascention* of *Cor. hidra* which is 9. *houres* 10.m, rest 10.m, which sheweth that *Cor. Hydra* comes to the *Meridian* 10.m, later then the *Sun* that day, that is, 10.m, after 12 and so the rest, whose *right ascention* is greater then the *Suns*. But for these *starres*, whose *right Ascention* is lesse then the said 9. *houres*, subtract this 9 *houre* from 24. *houres*, rest 15. *houre* (or rather subtract it from 12. rest 3. *houres*) this adde unto the *right ascention* of any of the aforesaid starres, as suppose *Canis Minor* makes 22. *houres* 20.m, which sheweth that *Canis minor*, wil come to the *Meridian*. 22. *houres* 20,m, later that day then the *sun*: therefore this, 22. *houres* and 20. m, being considered according to an hourly account sheweth, that *Canis Minor* will come to the *Meridian* at 10. of the *clocke* and 20.m: of the next day (the *right ascention* of the Interuall of time

time being neglected) or for brevitie adde the aforesaid 3. *houres* unto the *right ascention* of these *Starres*, whose *right ascentions* are lesser then the *Suns*, so have you the *Meridionall houre* required.

Hence may be gathered that *Ala Pegasi*, *Pri.* and *Aquila*, are onely for observation that night, the other *starres* are out of observation, and will come to the *Meridian*, in the day time.

Lastly, to finde the Meridionall Altitude of any of these Starres, lay the edge of the *Index* unto the *houre line*, of 12, so the parallel of the *Starres declination* that crosseth the edge of the *Index*, shall there shew you in the *Index*, the *Meridionall Altitude* of the *Starre* required.

Pro. 41. **Secondly, to know at any day, at what houre any of the ſtarres (inſcribed on the Inſtrument) riſeth or ſetteth, with their time of continuance above the Horizon, & in what part of the hemiſpheare, they may be ſeene, with their Azimuth, and Altitude at any houre.**

Conſtru. By the laſt direction finde the *houre* of the *ſtars* being in the *Meridian*, then marke what houre the parallel of the *declination* of any *ſtarre* interſecteth the *Horizon* or *Kalender*, ſo have you the *houre* or time of the *ſtarres riſing* or *ſetting*, and the number of *houres*, from that point of the *ſtars riſing* in the *Horizon*, unto the *Meridian* being doubled, gives the countinuance of the *ſtarres* above the *Horizon*, required.

Exam. So if upon the 6th. of *February*, it were demanded at what *houre Oculus* ♉. would aſcend, & how long it would continue above the *Horizon*.

By

By the laſt propoſition, get the *houre* of the *ſtarres* being in the *Meridian*, which is at 6. of the Clocke and 15. minuts at night, and marke the Number of *houres* betweene the *Meridian*, and that point where the parallel of *Oculus* ☌, meeteth with the *Kalender*, which is 7. *houres* 24. minuts, this doubled makes 14. *houres* 48.m, and ſo long will *Oculus* ☌, be above the *Horizon*.

But if from the ſaid 7, houres and 24. m, the ſaid 6, houres 15.m, be taken, there will reſt 1. houre 9.m, and ſo much before 12. of the clocke at noone, doth *Oculus* ☌ riſe, that is 51.m, after 10, of the Clocke, and ſo conſequently if the ſaid 7. *houres* and 24.m, be added unto the houre of the *ſtarres* being in the *Meridian*, viz. 6. of the Clocke and 15. m, as before, the ſaid *ſtarre* will ſet at 39.m, paſt 1, in the *Morning*.

Laſtly, if at any *houre* betweene the *riſing* of the *ſtarre*, and the *ſetting* thereof, it be required at what *Poſition* and *Altitude* the *ſtarre* is in. It is thus done.

Account to the given *houre*, from the *houre* of the *ſtarre riſing*, *ſetting*, or being in the *Meridian*, (in the parallel of the ſtarres declination) and lay the *Index* thereto, ſo the edge of it in the *Limbe* of the *Inſtrument*, ſhall ſhew the *ſtarres Azimuth* or *Poſition*, and where the parallel of the ſtarres *Declination* croſſeth the edge of the *Index*, that ſhall be the *ſtarres Altitude*, at that *houre*. *Conſtruct.* 56.

So if on the ſaid 6th. of *February*, at 11. of the *Clocke* at night, it were required in what *Poſition* *Exam.*

on

en, or *Azimuth Oculus* ☉, was in, and alſo how high above the *Horizon*: I make, or ſuppoſe the *houre* of 12. to be the aforeſaid 6. of the Clocke and 15.m, (for at that *houre* as before *Oculus* ☉ was in the *Meridian*) and from thence in the *ſtars* parallel of *Declination*, I account untill I come unto 11. of the *Clocke*, viz. that is 4. *houres*, and 45.m, from 12. and lay the *Index* thereto, ſo the edge of the *Index* in the *Limbe*, pointeth out 4.gr: 24.m, and ſo farre *Oculus* ☉, is diſtant from the *Weſt* at 11. of the *Clocke* at night, and the parallel of the *ſtarres Declination* meeteth with the *Index* in 24.gr, neere, which is the ſtarres *Altitude*, at that *houre* required.

Pro. 42.

Thirdly, to find in any night of the yeare, in what part of the Horizon any of the ſtarres on the inſtrument riſeth or ſetteth, and at what houre, and Altitude a ſtarre will be due Eaſt, or Weſt.

Conſtruction. 57 *For the firſt, Marke* where the parallel of the *ſtarres declination* croſſeth the *Horizon*, or *Kalender*, Lay the edge of the *Index* hereto, ſo the number

number of degrees betweene the edge of the *Index*, and the point of *East* or *West*, upon the *limbe* of the *Instrument*, sheweth the distance of the *starres rising* from the *East* or *West*.

So if it were required in what part of the *Horizon Oculus* ☌ riseth, marke where the parallel of the *starr Declination* crosseth the *Horizon*, and lay the edge of the *Index* thereto, so it cutteth the *Limbe* of the *Instrument* from the *East* neere 26. gr. and so farre *Oculus* ☌, riseth from the *East* towards the *North*. *Exam.*

For the second to finde the time of a starres coming East, or west.

By the 40th. *Pro.* consider at what houre the *starr* is in the *Meridian*, then lay the edge of the *Index* to the point of *East* and *West*, and account in the parallel of the *starr Declination* the number of *houres* betweene the edge of the *Index*, and the *houre* of 12. which being taken from the *houre* of the *starr* being in the *Meridian*, gives the *houre* of the *starr* coming *East*, but added unto the *houre* of the *starr* being in the *Meridian*, shewes the *houre* of the *starr* being *West*. *Constructio.* 58.

So if it were demaunded at what *houre*, upon the 6th. of *February*, Cor ♌, would be due *East* or *West*, and what *Altitude* the starre should then have. First, lay the edge of the *Index*, to the point of *East* and *West*. & whersoever the parallel of the starres *declination* crosseth the edge of the *Index* that shall be the starres *Altitude*, viz. neere 17. gr 45. m, then account the number of *houres* *Exam.*

in the parallel of the ſtarres *Declination* betweene the edge of the *Index*, and the *houre* of 12. which is neere 5. *houres* and 12. m, which taken from the *houre* of the ſtarres being in the *Meridian*,) which by the 40th. Pro. was at 11. of the *clocke* & 48. m, at night) reſts 6. *houres*, and 36. m: but if the ſaid 5. *houres* and 12. m, be added unto the ſaid 11. *houres* and 48. m, it makes 17. *houres*, from which 12. being taken leaves 5, *houres*. So upon the 6th. of *February*, Cor ♌ ſhall be due *Eaſt*, at 36. m, paſt 6, at night, and due *Weſt*, at 5, of the Clocke in the Morning, and the *Stars Altitude*, being either *Eaſt* or *Weſt*, is neere 17. gr. 45. m, as was required.

Pro. 43. *Fourthly, upon the ſight or appearance of any of the aforeſaid ſtars, to finde the Azimuth thereof, and the houre of the night.*

By the 40th. Pro. for the day given finde the *houre* of the *ſtarres* coming to the *Meridian*, then by the 27. Pro. take the *ſtarres* height, and account that height in the *Index*, then [illegible] *Index* untill the degree of the *ſtarres* [illegible] the *Index*, meete with the parallel [illegible] *Declination*, ſo the edge of the [illegible]

Conſtruct. *Pro.* 59.

ſheweth the ſtarres *Azimuth*, and the *Meridian* that meeteth with the degree of the *Altitude*, in the *Index* ſhall ſhew you the *houre* that the *ſtarre* wants to be in the *Meridian*, or is paſt the *Meridian*, which added, or ſubtracted from the *houre* of the *ſtarres* being in the *Meridian*, gives the *houre* of the night required.

So if the day were the 26th. of *Iuly*, and if *Aquila*, ſhould be obſerved to be on the *Weſt* of the *Meridian*, 29.gr.20.m, high above the *Horizon*, this I ſeeke out upon the *Index*, and move the *Index* to and fro untill the ſaid, 29.gr.20.m, meete with the parallel of *Declination*, of *Aquila*, ſo the edge of the *Index*, in the *Limbe* doth point out the *ſtarres Azimuth* from the *South*, viz. 63. gr.12.m, and the *Meridian* that meeteth with the aforeſaid degree of *Altitude*, is the time of the *ſtarres* diſtance from the *Meridian*, viz. neere 3. *houres* and 28.m, this added unto the *houre* of *Aquilas* being in the *Meridian*, which by the 40th. Pro. was at 10. of the Clocke & 32. m, at night, makes 14. *houres*, or 2 of the *Clocke*, in the *Morning*, ſo if *Aquila* were obſerved the 26th. of *Iuly*, to be 29.gr.20.m, *high* to the *Weſt* of the *Meridian*, then the *Poſition* or *Azimuth* of that *ſtarre* from the *Meridian*, was 63.gr.12.m, and the *houre* at that inſtant, was at 2. of the Clocke in the Morning. *Exam.*

Thus touching the resolution of the aforesaid 44.45.46. and 47th. *Pro.* of the aforesaid *Index* or *Table*, which did belong to *Astronomicall* observations, the last uses now follow, viz. 48.49.50.9.13.14. and 15th. uses of the *Index* or *Table*, which are onely proper to *Geometricall Practices*, viz.

to shew

1. *How to measure the Quantitie of an Angle, or to take the distance of two Starres.*
2. *How to measure distances and bredthes.*
3. *How to take the Circuit of a figure, or the surneigh of a Place.*
4. *The inclination of a Plaine, or to Place a Plaine Horizontall.*
5. *Whether an Altitude be in the Point of libration, or above, or below the level of the eye, and how much.*
6. *How much the hight of an Altitude is above the eye, which is accessable, or inaccessable.*
7. *How to measure any Part of an Altitude, which is not approachable.*

How

First, how to obſerue or finde the meaſure of an Angle, or take the diſtance of two ſtarres by the Inſtrument.

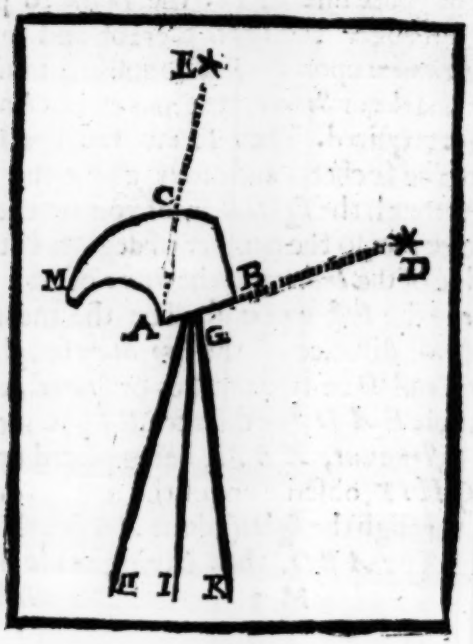
Pro. 44.

Let the *Inſtrument* be placed upon ſome *Reſt*, which may be ſo accommodated that the *Inſtrument*, may be elevated, depreſſed, or be placed *Horizontall*, as occaſion requires, then erect the ſights of the *Index*, & place the edge of the *Index* upon the houre line of 12. the *Index* ſo placed looke through the *ſights* thereof and moving the *Inſtrument* upon his *Reſt* to and fro, untill you ſee the marke or *Starre*, that makes the Angle or diſtance required. Then ſcrew faſt the *Inſtrument* to the ſocket, and move about the *Index*, untill through the *ſights* thereof you ſee the other marke or *ſtar*, ſo the number of degrees betweene the edge of the *Index* and the *houre* of 12. in the *Limbe* of the *Inſtrument* ſhall be the meaſure of § Angle, or diſtance of the *two Stars* ſought for. *Conſtruction* 60.

Let E and D be two markes or *Starres*, and let the Angle *E A D*, or diſtance *E D*, be required. The *Inſtrument*, *A B M*, being placed upon his *Reſt G H I K*, obſerue one of the markes or *ſtarres* as *D*, through the *ſights* (admit *A B*,) ſo the viſuall line ſhall be *A B D*, then having made faſt the *Exam:*

Instrument, move the *Index A B*, untill through the *sights* of it you see the other marke or *starre*, *E*, which suppose to be in the visuall line, *A C E*, so the Arke of the *Limbe* of the *Instrument B C*, shall be the distance betweene the two *Stars*, *ED*; or the measure of the Angle *E A D*, required.

Corollarie. Now Infinit are the uses of knowing the Quantitie of *Angles*, in the Copious and vast Body of *Mathematicall* Practices, therefore from the multitude of *Examples* that might be raised upon them, or extracted from them, I will onely instance for brevitie, upon these two plaine, and ordinary ones following.



Secondly, how to measure distances, and Breadths.

Pro. 45.

Exam.

Let O F L H, represent part of the *Perimeter* of a *Fort*, and let it be required, that standing at some convenient place without *Musket* shot, as admit at ϒ, the distance betweene the points of the *Bulwarke* viz. *F* & *L*, as also the measure of the *face* of either of the *Bulwarks* viz. *F E*, or *M L*, with the length of the *Cortaine D N*, and all the distances from ϒ, viz. ϒ*F*, ϒ *E*, ϒ *M*, and ϒ *L*, were required.

Or suppose O P Q R, were 4 places, whose severall distances the one from the other as from *O* to *P*, then from *P* to *Q*, and from *Q* to *R*, & also the severall distances from ϒ viz. ϒ*O*, ϒ*P*, ϒ*Q* and ϒ*R*, were demanded. The *Construction* and resolution upon either of these is alike, therefore we will instance upon the latter.

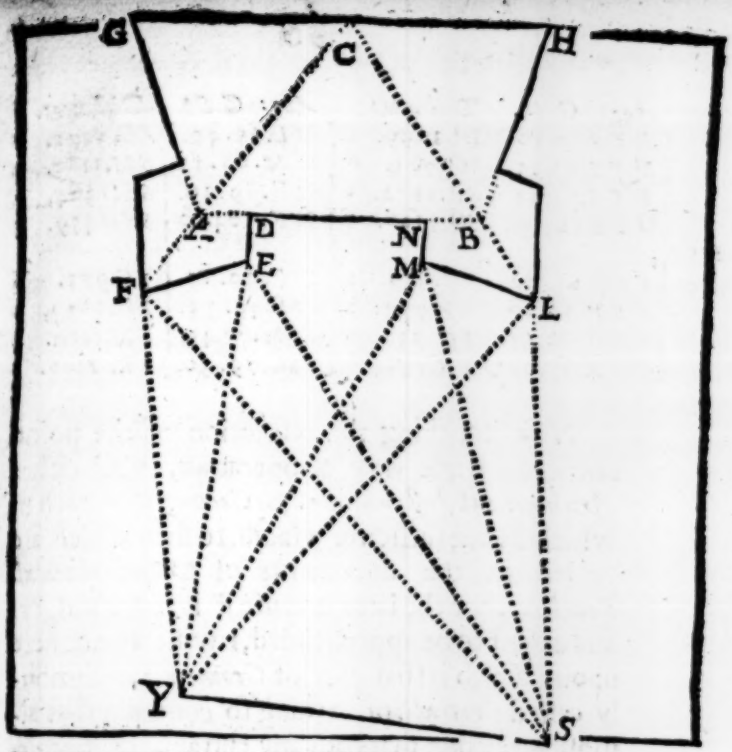
Constructio. 61.

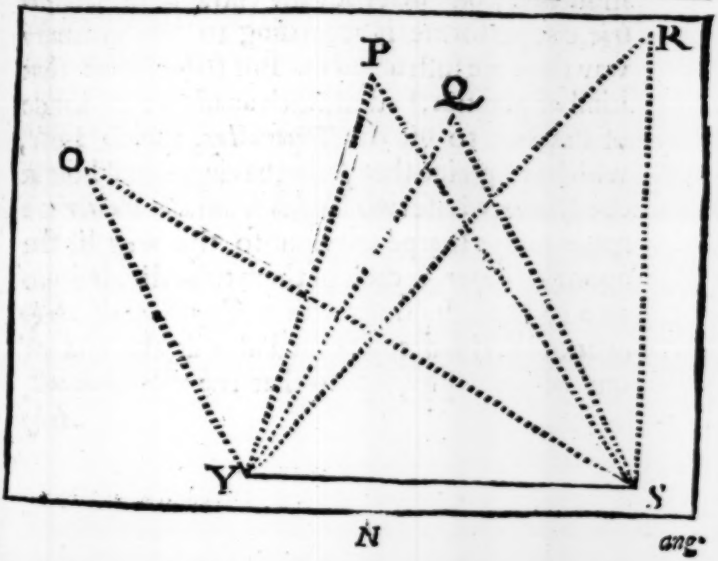
Place the *Instrument* upon his *Rest*, at ϒ, and the edge of the *Index*, upon the *houre* of 12. then looking through the *sights* of the *Index*, upon some marke taken at pleasure in the field, which, admit to be *S*, then observe the first marke *R*, so have you the Angle *S* ϒ *R*, which suppose 52. gr. 30. m, then looke to *Q*, so have you the Angle *S*ϒ*Q*, which let be 63. gr. 15. m, then looke to *P*, so have you the Angle *S*ϒ*P*, admit to be 74. gr. 15. m, and lastly looke to *O*, so have you the Angle

*S*ϒ*O*,

ΥO, 123.gr.15.m: for theſe Angles are taken with great facillitie, when once the *Inſtrument* is rectified as in the firſt direction is ſpecified, for you neede not but move the *Index*, *Circular* from obiect to obiect, ſo the Arkes of the *Limbe* of the *Inſtrument* as before, from the *houre* of 12, unto the edge of the *Index*, ſhall ſhew the meaſure of the ſeuerall Angles obſerved.

Thus at Υ, place up a Marke, and in the viſuall line, ΥS, and meaſure a certaine diſtance at pleaſure, as admit to S, and ſuppoſe it were found to be 900. foote (or 300. yardes) then placing the *Inſtrument* at S, upon his *Reſt*, and laying the edge of the *Index* to the *houre* of 12. I move the *Inſtrument* about, untill through the *ſights* of the *Index* I may ſee the marke which was ſet up at my laſt *Station*, then make faſt the *Inſtrument*, and obſerve O, ſo have you the Angle ΥSO, which ſuppoſe to be 26.gr.50.m, then looke to P, ſo have you the Angle ΥSP, which let be 55.gr.50.m, then looke to Ω, ſo have you the Angle $\Upsilon S\Omega$, which admit to be 60.gr. 15. m, laſtly obſerve R, ſo have you the Angle ΥSR, 87.gr. In like maner may you obſerve the Angles at the *Fort* from the ſtations Υ, and S, formerly ſpecified all which *obſervations* may be placed downe in *Tables*, as here under appeares, which may be called the *Tables* of obſerved Angles.





ang.

	Ang:	G.M.	Distances		Ang:	G.M.	Distances.	
	R T S.	52.30	SR. 1099.	5	S T L.	55.45.	SL. 1071.	0
	Q T S.	63.15	SQ. 963.	6	S T M.	68.15	SM. 1182.	2
	P T S.	74.15	SP. 1132.	2	S T E.	89.10.	SE. 1364.	4
	O T S.	123.50	SO. 1526.	1	S T F.	104.00	SF. 1459.	5
T S. 900.	T S O.	26. 50.	TO. 829.	2	T S F.	39. 15.	TF. 971.	6
	T S P.	55.50.	TP. 973.	2	T S E.	49. 35.	TE. 1039.	2
	T S Q.	60.15.	TQ. 937.	0	T S M.	66.45.	TM. 1169.	4
	T S R.	87.00.	TR. 1384.		T S L.	79. 30.	TL. 1268.	2

Now touching the resolution of the point, there is a triple way of operation, viz. either *Arithmeticall*, *Instrumentall*, or *Geometricall*, each of which being sufficiently facill, to such which are versed in the documents of *Mathematicall Practices*, but the later because it is more vulgar, and easiest to be apprehended, I will instance here upon: which is that part of *Geometrie*, commonly called *Protraction*, a thing so common that almost every one that hath any entrance in *Geometrie*, can performe it according to the ordinary way they are instructed in. But to facilitate that kind of practice, I aduise such as affect this kinde of Practice to use the *Protracter*, which I use, which is a plaine then *sector*, having a smal hole at the *Center*, whose two legges from the *Center* are made with a sharpe edge, but so that they lie flat upon the *Paper*, & each of them to be divided into 100 or 1000 diuisions with a *Quadrantall Arke* or more divided: and fastned also at the end of one of the leggs, but so that the *Quadrantall*,

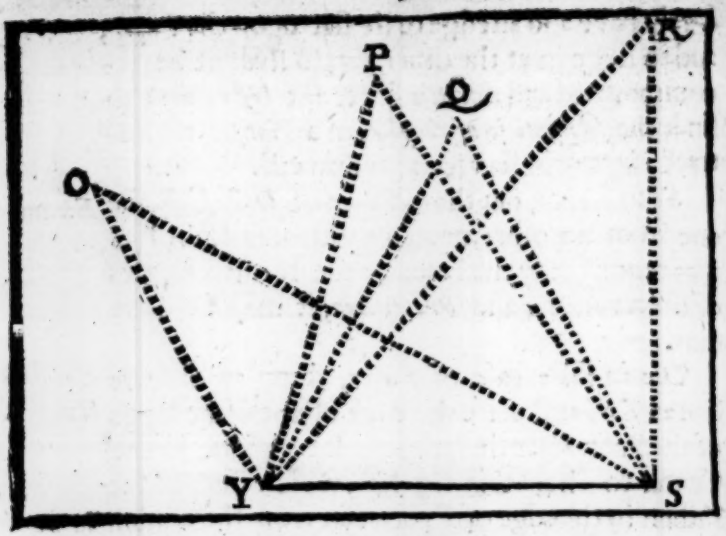
Ark:

Arke have alſo an edge to lie flat upon the *Paper*, and to ſlide in at the other leg, ſo ſhall it be accommodated and made a fit, & apt *Inſtrument* to finde the *Quantitie of Angles*, in a *Plot*, or to protract *Angles*, for ſervice, as followeth.

So to ſearch out the diſtance of *O P Q R*, the one from the other, or all the diſtances from *Υ* as was required: by the helpe of the former Angles of obſervations and *Protracter*, it may be done thus. *Exam.*

Upon a faire leafe of *Paper*, draw an obſcure line as *Υ S*, and place the edge of one of the leggs of the Protracter thereto, and ſet a pinne in the Center to hold that leg faſt, which ſuppoſe at *Υ*, then in the edge of Protracter from the Center the account, 90o. & make a point upon the *Paper*, unto which write *S*, then account. 52. gr. 30. m, in the *Quadrantall Arke* (which is the Angle *RΥS*, ſpecified in the aforeſaid Table of Angles) and move the edge of the other leg of the *Protracter* unto it, and by that edge draw the line *Υ R*, then account 63. gr. 15. m, in the ſaid *Quadrantall Arke*, and move the former legge, unto it, and draw the line *Υ Q*. In like manner may you account the reſt of the Angles out of the aforeſaid *Table of Angles* in the former *Quadrantall Arke*, and ſo draw the other lines *Υ P*, and *Υ O*. Laſtly, lay the Center of the *Protracter* upon *S*, and the edge of one of the leggs thereof upon the line *S Υ*, then in the *Quadrantall Arke* account 26. gr. 50. m, which is the Angle *Υ S O*, as is before ſpe- *Conſtru Sect. 62.*

 cified



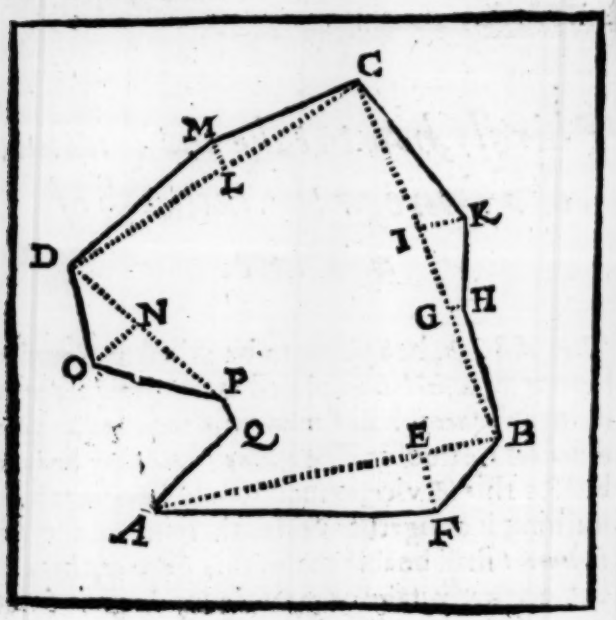
cified in the *Table of Angles*, and lay the edge of the other legge of the *Protractor* unto it, and draw the line *S O*. Now marke whether the line *S O*, meets with the line *Y O*, which will be at *O*, so *S O*, shall be one of the distances required, and shall be measured or given in the edge of the *Protractor*, to be 1526,1 foot. In like manner account 55.gr.50.m, in the *Quadrantall Arke*, which is the Angle *YSP*, and move the edge of the *Protractor* to it, and draw the line *SP*, and also marke where the edge of the *Protractor* meets with the line *YP*, which will be at *P*, so *P S*, shall be another distance, and also measured in the edge of the *Protractor* as before, viz. 1132. foote. *In like maner* may you *Protract* the other Angles, and

and ſo alſo draw the reſt of the lines, *S Q*, and *S R*, then laying the Center of the *Protracter* upon *T*, and one of the edges being moved to any line, would inſtantly ſhew you the meaſure of that line which is the diſtance required viz. *T O*, 8292. *T P*, 9732. *T Q*. 937.0, and *T R*, 1384. foote and theſe meaſures with the reſt are placed oppoſite to each Angle, in the aforeſaid ſpecified *Table of Angles*: now if you place the Center of the *Protractor* upon *O*, and move one of the leggs to *P*, ſo have you the bredth *O P*, in the edge of the *Protracter*, and ſo of others: Thus for the firſt example upon the uſe of Angles in Bredth and Diſtances, the ſecond followeth:

Thirdly, how to take the Circuite of a figure, or the ſurueigh of a Place. Pro. 46.

Let ABCD, be a plaine to be raiſed as *Fortifiers* have it, or a *field* to be ploted as *ſurveyers* account it, or a *Figure* whoſe *Perimeter* is required, as *Geometritiãs* treate of it. The *Plaine Table*, may be held beſt for this ſervice, as ſuch would have it, whoſe learning is altogether verſed therein. But any *Inſtrument* ſhall be able to doe this *Service*, that can but accurately take or meaſure any Angle, (not that *Exam.* *Notatio.*

that we reject that, but make uſe of this for the preſent) and therefore in this action, it were no loſſe of time to make a preambulation about the field, to view the ſeverall windings and turnings thereof, and what *Angles* with greateſt Conveniency, and expedition are to be obſerved, and what might be omitted, and at the *Angles* of conſequence there to ſet up ſome marke, and upon thoſe *Angles* to fabricate the whole worke: for here eſpecially is to be noted, that the more *Angles* that are obſerued in any practiſe, by way of Circumſcribing a *Field*, or *Campaigne*, the greater, and more evident ſhall the error be in the Concluſion.



So

So in the *Figure A B C D*, there is eleven *Angles* and as many sides, now if at every *Angle*, an observation should be made, it would be more subiect to error (as before) then if lesse *Angles* were observed, therfore in this *Diagramme* fewer *Angles* of observation may be fully sufficient to raise that *Plaine*, Take the *Plot* of the *Field*, or give the *Perimeter* of that *Figure*, Therefore suppose the noted *Angles* of Consequence to be, *A, B, C, D, Q*, the worke may be then thus. *Exam.*

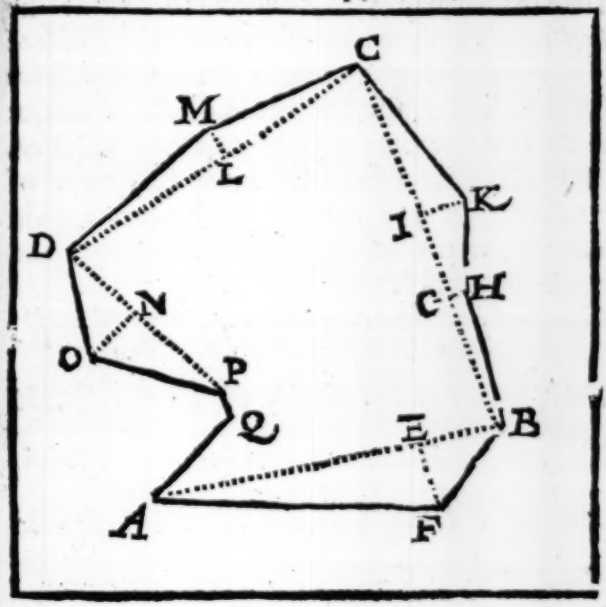
Place the *Instrument*, upon his rest at *A*, and observe the *Angle Q AB*, which suppose 32.gr.10 m, then measure *Q A*, with a *Decimall* Chaine (or such like,) which suppose to be 5. Chaines, note this in a peece of paper, then take the *Instrument* up, and measure the line, *AB*, but first onely *AE*, which suppose to be 11. Chaines and 60 Linkes, which is written down thus. 11.60. Then measure the distance from *E* to the Angle *F*, which admit to be 2. 20, Lastly, go one with the measure *A B*, which suppose to be 15. 00, the Angle of obseruation, and measures thus taken may be noted downe one against another, as in the *Table* following, then place the *Instrument* upon his rest at *B*, and obserue the Angle: *ABC*, which note downe also and measure the distance, *B G*, and *G H*, and then going on with *G B*, to *G I*, and marke and measure *B I*, and then measure also *I K*, and so goe on with *B C*, which *measures* are all placed down as appeares in the *Table* of *Angles* and *Construction* 63.

and measures following: In like maner performe the reſt of the worke untill you come to 2, and ſo all the *Angles* and *meaſures* will be according to the *Table* here under ſpecified.

The Table of Angles:	*The Table of meaſures*
G.M.	5. 00.
32.10.	11. 60.
	2.20.
	15. 00.
	6. 00.
	1.00.
80.10.	9. 20.
	2.00.
	16. 40.
	6. 90.
79.30.	1. 20.
	8. 00.
	3. 70.
74. 45.	1. 15.
	5. 40.

Having theſe obſervations and meaſures, they may be *Protracted* thus: upon a faire ſheete or leafe of *Paper*, draw an obſcure line as *A B*, and place the edge of the *Protracter* thereto, then keeping the edge of the *Protracter* faſt upon the line *A B*, open the other edge to an *Angle* equall to *B A Q*, viz. 32. gr. 10. m, then place the pine in the *Center*, & make a marke at *A*, and account in the edge of the *Protracter* the meaſures of the lines *A Q*, *A E*, *A B*, out of the Table of meaſures, and make markes with a pin, or ſuch like at the terms therof. viz, at *Q F*, & *B*, then open the *Protracter*, at a right *Angle*, & place the *Center* upon *E* & one the edges of it upon the line *A E*, ſo the meaſure of of the line *E F*, may be accounted in the edge of the *Protracter*: then draw apparently *A F*, & *F B*;

Conſtruction. 64.



O ſo

ſo have you *Protracted* a part of the *figure*, then lay the *Center* of the *Protracter* upon *B*, and one of the edges upon the line *B A*, and open the other edge unto 80.gr.10.m, according to the *Angle A B C*, then in that edge out of the former *Table* account from the *Center B*, 6.00 and make a point at the terme therof, which admit at *G*, then account 9.20. and at the end of it make another point, which admit *I*, laſtly, in the edge of the *Protracter* account 16.40. and at the end of it make a point, which ſuppoſe *C*, and according to the former directions *Protract* alſo out of the *Table* of meaſures, the meaſure for *G H*, and *I K*, then laſtly draw apparntly, *B H*, *H K*, and *K C*: In like maner may you *Protract* the reſt of the *Angles*, and meaſures out of the aforeſaid *Table* of *Meaſures* and *Angles*, and ſo the whole *Plaine A B C D*, ſhal be raiſed, or the ſaid field *Plotted*, or the *Perimeter* of the figure given, as was required.

But it had beene fully ſufficient (by helpe of this *Protractor*) to have plotted the aforeſaid *Plaine*, by knowing the former *Meaſures*, and two Angles of obſeruation only.

Pro; 47. ***Fourthly, how to finde the Inclination of a Plaine, or to Elevate a Plaine unto an Angle aſſigned, and to Place a Plaine Horizontall.***

Conſtruction.65. *For the firſt*, Set the *Eaſt* and *Weſt*, edge of the

Inſtrument unto the *Plaine*, then if the edge of the *Index* in the *Limbe* of the *Inſtrument*, cut the point of *Eaſt* or *Weſt*, the *Plaine* is *verticall*, and doth not *Incline*, but if the *Index* fall from the points, looke how many degrees it is from the points of *Eaſt* or *Weſt* in the *Limbe* of the *Inſtrument* ſo much is that *Inclination* of the *Plaine*.

For the Second, to Elevate a Plaine, to an Angle aſſigned.

This is onely the ſame with the former, but may be applyed to ſeverall uſes, as to trie the mount, or to mount a *Peece* of *Ordinance* at any *Random*: or to place *Burning glaſſes* (or others) at ſeverall Angles, to receive each others *Reflexion*, and that the point of concurſe, or *inflammation* in ſuch *Glaſſes* may be in the *Radius* or beame of the *Sunne*, or that the point of *inflamation*, the repreſentative *Image*, or the extenſive *Elumination* may be proiected to a point aſſigned.

For the Third, to rectifie a Plaine Horizontall. *Conſtruction.66.*

Place the *North* and *South* edge of the *Inſtrument*, unto the under face of the *Plaine*, and then marke if the edge of the *Index*, cut the points of *Eaſt* or *Weſt* in the *Limbe* of the *Inſtrument*, for then the *Plaine* is *Horizontall*, but if it ſwarue from that point, then it is not *Horizontal*, but the *Plaine* is to be raiſed, or depreſſed, untill by ſeverall tryalls in ſundry parts of the *Plaine*, you ſee the edge of the *Index* fall upon the points of *Eaſt* or *Weſt*, for then ſhall it be truly *Horizontall*: Otherwiſe you may rectifie the *Plaine Horizontall*, by operating upon the upper face of it, if you ſet a

Cube upon the plaine, and then placing the *East* and *West* edge of the *Instrument* unto the side of the *Cube*, for then the obseruation will be as the former, and therefore, accommodated & concluded accordingly.

Pro. 48. ## *Fiftly, to finde whether an Altitude be in the Point of libration, or above, or below the levell of the eye, and how much.*

Declaration. *Let C B* and *X*, be three severall obiects, and let their severall situations be required.

Construction.67. *First*, let the *Instrument* hang upon a rest perpendicular, and let it be held stedfast that the *Index* may be verticall, and play easily by the side of the *Instrument*, then looking through the *sights* of it, lift the *Instrument* up and downe, untill you see your marke, which suppose first *C*, and admit the *Index* should cut 5. in the line of *shadowes*, which sheweth that *C*, is higher then the eye by the 5th. part of the distance of the bassis of the obiect, from the eye, supposed at *A*.

Secondly, if through the *sights* of the *Instrument* you see the second obiect, *B* and the *Index* falling upon no part in the line of *shadowes*, then it sheweth that the point *B*, is levell with the eye, for if in any obseruation the *Index* fall betweene the beginning of the line of *shadowes*, (which is neere the begining of *December*) and the sight next the

the eye, it argueth that the obiect is higher then the eye, but if the *Index* fall beyond the beginning of the line of ſhadowes, then the obiect is lower then the eye.

Thirdly, if you obſerve the obiect *X*, (the eye being at *A*,) then if in obſerving the *Marke* *X*, through the *ſights* of the *Inſtrument*, the *Index* ſhall fall beyond the beginning of the line of *ſhadowes*, that is from the *Kalender* number the degrees, in the *Limbe* from the edge of the *Index* unto that point, and account the ſame backward from the point in the *Limbe* that is oppoſit to the beginning of the line of *ſhadowes*, and lay the edge of the *Index* unto it, then ſuppoſe the *Index*, in the line of *ſhadowes* interſect 8. which ſheweth that the point *X* is lower then the levell of the eye, by the eight part of the diſtance from you to the marke. Now if the diſtance ſhould be 100. foote, then the point *X*, ſhall be below the *Horizontall* line, or line of levell *A B*, 12. foote and $\frac{1}{2}$ which is the $\frac{1}{8}$ part of 100. the diſtance before ſpecified. *Conſtruct.* 68.

Sixtly, how to finde the height of an Altitude above the levell of of the eye, either Acceſsible, or inacceſsible. *Pro.* 49.

Let, B C be an *Altitude* and the eye at, *A* diſtant from the *Baſis* of *B*, 100. foote. *Declara.* 110.

If through the *ſights* of the *Inſtrument* the ſummet of the *Altitude B C*, viz. *C*, be ſeene, and the *Index* falling upon 5, in the line of *ſhadowes*, it argueth the *Altitude B C*, to be the 5 th. part of the diſtance, viz. of *A. B.* which is 20. foot. *Or* let the *Altitude* of *G*, be ſought out, whoſe *Baſis* cannot be ſeene Admit, the firſt ſtation be made at *A* and ſeing the ſummet of the *Altitude G*, the *Index* ſhould cut 3 in the line of *ſhadowes*, it Argueth that the diſtance to the *Baſis* of the *Altitude*, is triple to the *Altitude*, then if I ſhould go neerer to the *Altitude*, viz. at *D*, and ſhould obſerue the ſummet or top of the *Altitude G*, and that the *Index* ſhould fall upon 1. in the line of *ſhadowes*, then it ſheweth that the diſtance from *D*, to the *Baſis* of the *Altitude* is equall to the *Altitude*. Now ſuppoſe that betweene *D* and *A* were 80. foote it ſhould ſeeme that the *Altitude* obſerued ſhould be 40. foote, for if at *D*, the diſtance to the *Altitude* be equall to the *Altitude*, & the diſtance from *A*, to the *Altitude*, be *Triple* to the *Altitude*, then the diſtance from *D* to the *Altitude* is the $\frac{1}{3}$ of the diſtance *A R*, & ſo *A D*, ſhall be double to *D R*, therefore halfe the diſtance *A D*, viz. 40. foot is the *Altitude* required.

Conſtruction. 69.

Por. 50.

Seventhly, to meaſure any part of an Altitude which is not approachable.

Declaratio.

Let G H, a part of an *Altitude* be required to be meaſured.

Firſt

First, ſearch out the height *G R*, as before 40. foote, then admit ſtanding at *A* and looking to *H*, through the ſights, the *Index* ſhould cut 4, which ſhewes the diſtance from *A*, to be *Quadruple* to the *Altitude* of *H R*, and if comming neerer the *Altitude* 80. foote, viz. at *D*, *I* ſhou ld obſerve *H* againe, through the *ſights* of the *Inſtrument*, and finde the *Index* to cut 1, and $\frac{1}{3}$, in the line of the *ſhadowes*, then the diſtance from *D*, to the *Altitude H R*, viz. *D R*, ſhould containe the *Altitude H R*, once, and a third part of the *Altitude*, now ſeeing that *D R*, is 1 and $\frac{1}{3}$, therefore *H R*, ſhall be 1, but the obſervation at *A* ſhewed the diſtance from *A*, to the *Altitude H R*, to be *Quadruple*, and ſeeing that *D R*, is 1, and 1 part of 3, therefore *A D*, muſt be 2, and 2 parts of 3, which makes *A R*, the whole diſtance to be 4, or *Quadruple* to *H R*, but if *A B*, 2, and 2 parts be 80. foote then *D R*, being 1, and 1, part ſhall be 40 foote, and if *D R*, 1, and $\frac{1}{3}$, be 40. foote, then *H R*, (which was 1 ſhould be but 30. foote, & ſo conſequently *H R*,) taken from *G R*, there ſhall remaine *G H*, 10. foote, the meaſure of the part of the *Altitude* required. In like manner might we applie the *Inſtrument* to the meaſuring of Bredths and diſtances: but that which is delivered may ſerue for the preſent, and as fully ſufficient for the Ingenious. *Conſtructio.70.*

Concluſion,

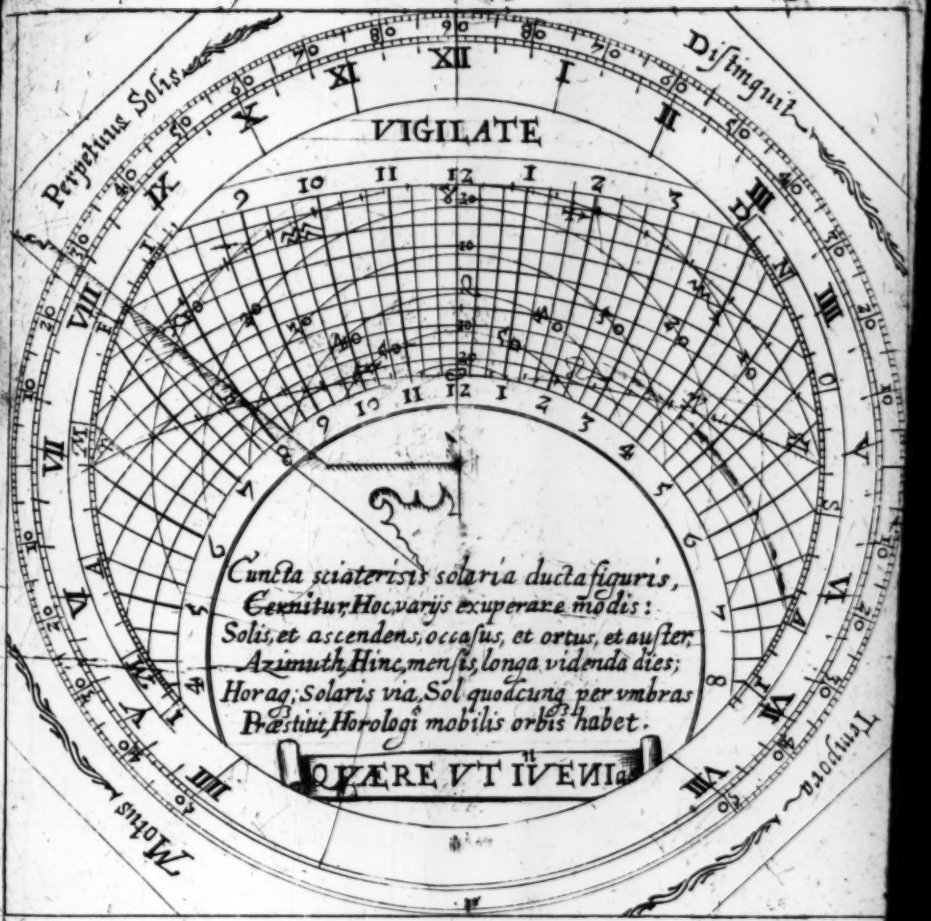
Concluſion.

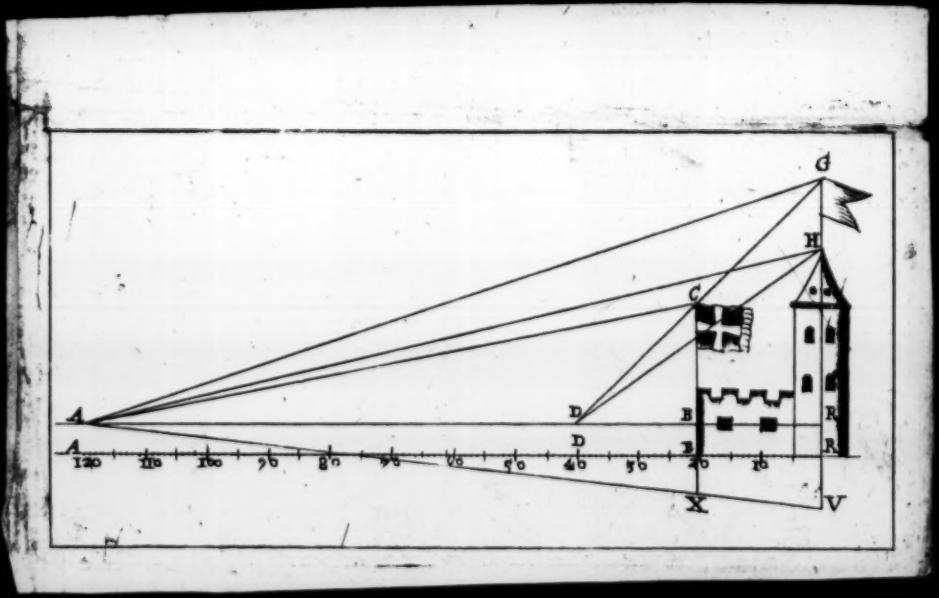
I might have Annexed unto this *Tractat* the demonſtration of this *Proiection*, which might have ſatisfied thoſe which are more learned, but to ſhew them it would be impertinent, ſeeing the thing lies ſo obuious: for others, it would not be reſpected or regarded, ſeeing the making, and practicall uſe of the *Inſtrument*, principally & Totally they looke after, which I have plentifully delivered. Now by way of Compariſon it is ſaid in the deſcription of *Maſter Gunters Quadrant*, that if a *Quadrant* were made (as he there relateth) unto a foote ſemidiameter, it ſhould ſhew the *Azimuth* unto a degree, & the houre unto a minute. It is moſt probable that if this *Horizontal Quadrant* have the ſame *ſemidiameter*, it ſhal ſhew the *houre* unto half a minut, and the *Azimuth* unto 3 m. And if in this *Tractat* I have beene too obſcure (which I have avoyded as much as poſſible I could,) I intreat the *Reader* to excuſe me. I confeſſe I might more Methodically have digeſted it, and more aboundantly Amplified it, howſoever the affectionate I perſwade my ſelfe will not ſpurne at that which I have delivered; as for the Malevolent I way not: my few houres would not permit me to make a long premeditation of ſo great a facilitie. But if any one deſire to ſay more upon this *Horizontall Quadrant*, then I have done: I have made way for him, and vnvailed the ſubject, to helpe his ſight.

From my houſe in Chancery-Lane, Ianuary, Anno. 1631.

Deus donat & digerit.

FINIS.


VIGILATE
Perpetuus Solis
Distinguit
Mobilis
Temporal
Cuncta sciateristis solaria ducta figuris,
Cernitur, Hoc variis exuperare modis:
Solis, et ascendens, occasus, et ortus, et auster,
Azimuth, Hinc, mensis, longa videnda dies;
Horaq; Solaris via, Sol quodcunq; per vmbras
Præstitit, Horologi mobilis orbis habet.
QVÆRE, VT INVENIAS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